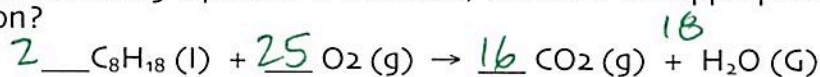


## 2014 STOICH/RXNS/EMPIRICAL FORMULA REVIEW PRACTICE TEST

- \_\_\_\_\_ 1. When the following equation is balanced, what are the appropriate coefficients in the equation?



- \_\_\_\_\_ 2. The molecular weight of ~~sucrose~~ (C<sub>8</sub>H<sub>10</sub>N<sub>4</sub>O<sub>2</sub>), caffeine is \_\_\_\_\_ amu.

$$8(12.01) + 10(1.01) + 4(14.01) + 2(16.00) = 194.22 \text{ amu}$$

- \_\_\_\_\_ 3. When the following equation is balanced, the coefficients are \_\_\_\_\_.



- \_\_\_\_\_ 4. Which one(s) of the following do(es) **not** occur as diatomic molecules in elemental form?

Sulfur, nitrogen, hydrogen, bromine, oxygen, iron, carbon

- \_\_\_\_\_ 5. In a chemical reaction the limiting reagent will be the substance \_\_\_\_\_.

*that is used up, causing the rxn to stop.*

- \_\_\_\_\_ 6. In addition to atoms, the only quantity conserved (is equal on both sides of an equation) in every chemical reaction is \_\_\_\_\_.

*energy or mass*

- \_\_\_\_\_ 7. The \_\_\_\_\_ in a balanced equation reveals the mole ratios of the substances involved.

*Coefficients.*

- \_\_\_\_\_ 8. In using balanced equations to solve mass-mass problems, the mass of each reactant is first converted to \_\_\_\_\_.

*moles!*

- \_\_\_\_\_ 9. What is the volume of a mole of a gas at standard temperature and pressure (STP)?

*22.4 L*

- \_\_\_\_\_ 10. In mass-mass problems, the steps to follow are best summarized as going from \_\_\_\_\_.

*mass  $\xrightarrow{\div \text{MM}}$  moles, to moles of another reagent, to mass of  $\xrightarrow{\times \text{MM}}$  product*

- \_\_\_\_\_ 11. The excess reactant in a completed chemical reaction will be the substance \_\_\_\_\_.

*that is left over after the reaction, or in excess.*

- \_\_\_\_\_ 12. What step is the first to complete in every single stoichiometric problem?

*Balance the DANG EQUATION 1st!*

- \_\_\_\_\_ 13. Considering the following balanced equation:

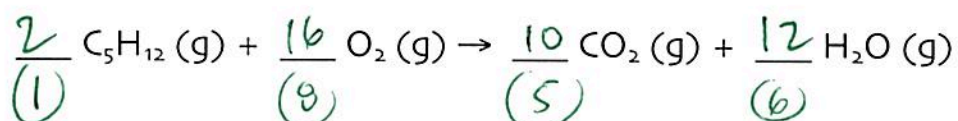


If 2.45 moles of CaC<sub>2</sub> are added to water, how many liters of C<sub>2</sub>H<sub>2</sub> will form at STP?

$$2.45 \text{ mol CaC}_2 \times \frac{1 \text{ mol CaC}_2}{64.10 \text{ g CaC}_2} \times \frac{1 \text{ mol C}_2\text{H}_2}{1 \text{ mol CaC}_2} \times \frac{22.4 \text{ L}}{1 \text{ mol C}_2\text{H}_2} = \boxed{0.957 \text{ L C}_2\text{H}_2}$$

Stoichiometry calculations: You must use dimensional analysis and show all of your work!

Questions 14 & 15 will refer to the following *unbalanced* equation.



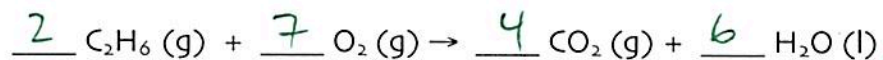
14. If 32.15 grams of  $\text{C}_5\text{H}_{12}$  were burned with unlimited  $\text{O}_2$ , how many moles of  $\text{H}_2\text{O}$  would form?

$$32.15 \text{ g C}_5\text{H}_{12} \times \frac{1 \text{ mol C}_5\text{H}_{12}}{72.17 \text{ g C}_5\text{H}_{12}} \times \frac{6 \text{ mol H}_2\text{O}}{1 \text{ mol C}_5\text{H}_{12}} = \underline{2.673 \text{ mol H}_2\text{O}}$$

15. If 65.7 L of  $\text{O}_2$  were burned with excess  $\text{C}_5\text{H}_{12}$ , how many grams of  $\text{CO}_2$  would form?

$$65.7 \text{ L O}_2 \times \frac{1 \text{ mol O}_2}{22.4 \text{ L O}_2} \times \frac{5 \text{ mol CO}_2}{8 \text{ mol O}_2} \times \frac{44.01 \text{ g CO}_2}{1 \text{ mol CO}_2} = \underline{80.6 \text{ g CO}_2}$$

Questions 16 & 17 will be based on the following *balanced* equation:



16. If 12.06 grams of  $\text{C}_2\text{H}_6$  were burned with 96.5 grams of  $\text{O}_2$ .  
What is the limiting reagent?

$$12.06 \text{ g C}_2\text{H}_6 \times \frac{1 \text{ mol C}_2\text{H}_6}{30.08 \text{ g C}_2\text{H}_6} \times \frac{4 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_6} = \underline{.8019 \text{ mol CO}_2}$$

*C<sub>2</sub>H<sub>6</sub> is the limit!*

$$96.5 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} \times \frac{4 \text{ mol CO}_2}{7 \text{ mol O}_2} = \underline{1.72 \text{ mol CO}_2}$$

$$[.8019 < 1.72]$$

17. How many molecules of  $\text{CO}_2$  will be formed when the reaction in question 16 takes place?

$$0.8019 \text{ mol CO}_2 \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol CO}_2} = 4.83 \times 10^{23} \text{ molecules of CO}_2$$

# % Composition, Empirical and Molecular Formula Problems.

18. The following percentages are based on mass. The chemical aspirin, acetylsalicylic acid, contains 59.99% Carbon, 4.48% Hydrogen, and 35.52% Oxygen. A) What is the empirical formula of this compound?

$$59.99 \text{ g C} \times \frac{1 \text{ mol C}}{12.01 \text{ g C}} = \frac{4.995 \text{ mol C}}{2.22} = 2.25 \text{ C}$$

$$4.48 \text{ g H} \times \frac{1 \text{ mol H}}{1.01 \text{ g H}} = \frac{4.44 \text{ mol H}}{2.22} = 2 \text{ mol H}$$

$$35.52 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = \frac{2.22 \text{ mol O}}{2.22} = 1 \text{ O}$$



B) If the molar mass of this compound is 180.17 g/mol, what is the molecular formula?

$$\begin{array}{r} 9 \times 12.01 \\ + 8 \times 1.01 \\ + 4 \times 16.00 \\ \hline 180.17 \end{array}$$

Molecular  
Formula

is  
The Same  
 $\text{C}_9\text{H}_8\text{O}_4$

19. What is the percent composition of the elements in iron(III)oxalate,  $\text{Fe}_2(\text{C}_2\text{O}_4)_3$ ?

$$\frac{55.85(2)}{375.76 \text{ g}} = \frac{111.70}{375.76} \times 100 = \% \text{ Fe} = \boxed{29.73\% \text{ Fe}}$$

$$\frac{72.06 \text{ g C}}{375.76 \text{ g}} \times 100 = \boxed{19.18\% \text{ Carbon}}$$

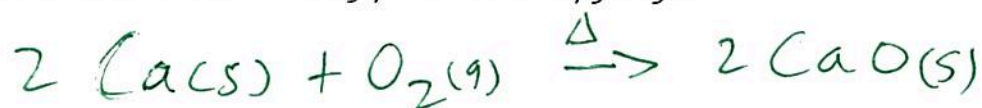
$$\frac{192 \text{ g O}}{375.76 \text{ g}} \times 100 = \boxed{51.10\% \text{ Oxygen}}$$



## Reaction families and Descriptive Chemistry

For questions 20-27, first predict the products and then balance the equation.

20. Solid calcium metal is strongly heated in oxygen gas.



21. What reaction family is taking place in question 20?

Synthesis / combination.

22. An aqueous solution of potassium peroxide ( $\text{O}_2^{2-}$ ) is decomposed.



23. What reaction family is taking place in question 22?

decomposition.

24. A piece of solid magnesium metal is placed in a beaker of aqueous hydrochloric acid.



25. What reaction family is taking place in question 24?

Single replacement.

26. Liquid nonane ( $\text{C}_9\text{H}_{20}$ ) is burned in the presence of oxygen gas.



27. What reaction family is taking place in question 26?

combustion!