CHEM 202 Accelerated General Chemistry I Week 2 – Stoichiometry III MERIT TA: Alex Wang August 31<sup>st</sup>, 2020 Section AQG



## **Discussion Questions**

- 1. You know that chemical A reacts with chemical B. You react 10.0 g A with 10.0 g B. What information do you need to determine the amount of product you make?
- 2. Consider a reaction in which two reactants make one product (for example, consider the unbalanced A + B  $\rightarrow$  C). You know the following:

2.0 moles of A (with an excess of B) can make a maximum of 2.0 moles C5.0 moles of B (with an excess of A) can make a maximum of 4.0 moles C

If you react 10.0 moles of A and 10.0 of B, what is the maximum amount of C that can be produced?

3. Caffeine is a stimulant most commonly found in coffee and is 5.19% hydrogen by mass. The molecular formula of caffeine is  $C_xH_{10}N_4O_2$ . Determine the value of x.

4. An unknown binary compound containing hydrogen  $(XH_n)$  has a density as a gas that is 2.393 times that of oxygen gas under the same conditions. When  $2.23 \times 10^{-2}$  mole of this compound reacts with excess oxygen gas, 0.803 g of water is produced. Identify the element X in this compound.

- 5. You are lost in a desert. All you have is 16.0 g of hydrogen gas and 22.0 g oxygen gas. You mix the two gases in a balloon, and lighting strikes the balloon (because you creatively tied a key to the string) creating water. You obtain 20.0 g of water to drink (YAY!!). Answer the following:
  - a. Write the balanced chemical reaction.
  - b. Determine the limiting and excess reagents.
  - c. State the amount of excess reagent remaining after the reaction occurs.
  - d. Calculate theoretical yield assuming reaction goes to completion.
  - e. Calculate % yield.

6. A 9.780-g gaseous mixture contains ethane ( $C_2H_6$ ) and propane ( $C_3H_8$ ). Complete combustion to form carbon dioxide and water requires 1.120 moles of oxygen gas. Calculate the mass percent of ethane in the original mixture.

 Consider the reaction of 19.0 grams of zinc with excess silver nitrite to produce silver metal and zinc nitrite. The reaction is stopped before all the zinc metal has reacted, and 29.0 g of solid metal is present. Calculate the mass of each metal in 29.0-g mixture.

 A 2.25-g sample of scandium metal is reacted with excess hydrochloric acid to produce 0.1502 g hydrogen gas. What is the formula of the scandium chloride produced in the reaction? (3.128) 9. Solid sodium bicarbonate (baking soda) decomposes upon heating to form solid sodium carbonate, water vapor, and carbon dioxide gas.

Suppose you are given an "unknown" mixture of sodium bicarbonate and sodium carbonate and are asked to determine the mass percent of sodium bicarbonate in the mixture. You find the mass of the mixture to be 27.00 g and begin heating it. After a few minutes your hot plate breaks and you do not know if all of the original baking soda has decomposed. You are running out of time, so you cool the sample and measure its mass, finding it to be 25.155 g.

It turns out that, given your data, you can determine **at least one** of the following (you may be able to determine two, or even all three - this is for you to decide). **Circle "YES" or "NO"** after each of the three questions below (remembering that **the answer to at least one of these is "YES"**).

- Can you determine the mass of sodium bicarbonate that decomposed? YES NO
- Can you determine the mass of sodium bicarbonate in the original mixture?
  YES NO
- Can you determine whether or not the reaction went to completion (that is, whether or not there is any sodium bicarbonate left after heating)? YES NO

In the space below, and on the next page, **provide verbal and mathematical support for your choices**. For example, if you answer "YES" to either of the first two question, then determine the mass. If you answer "NO", show why you cannot determine the mass. If you answer "YES" to the third question, then state either "the reaction went to completion or "the reaction did not go to completion" and provide proof. If you answer "NO" to this, show why you cannot determine it. **Explain completely, show all work, and define any variables fully and carefully**.