Stoichiometry quiz essay sample

Stoichiometry II – Mole Calculations/ Limiting and Excess Reagent – Lecture Notes 1. Given the balanced equation N2(g) + 3H2(g) 🡪 2NH3(g) How many moles of ammonia are produced when 0. 60 mol of nitrogen reacts with hydrogen? 2. Given the equation: SiO2 + HF 🡪 SiF4 + H2O a. Calculate the number of moles HF that would completely react with 2. 5 moles of SiO2. b. Calculate the number of moles SiF4 formed by completely reacting 2. 5 moles SiO 2 with HF. c. Calculate the mass of water formed by reacting 2. 5 moles SiO 2 with HF.

d. Calculate the number of water molecules formed by reacting 2. 5 moles SiO 2 with HF.

e. Calculate the mass of oxygen formed by reacting 2. 5 moles SiO 2 with HF. 3. Calculate the number of grams NH3 produced by the reaction of 5. 40 grams of hydrogen with an excess nitrogen.

1. The overall reaction for the conversion of sugar(glucose) to acetic acid is: C6H12O6 + 2O2 🡪 2CH3COOH + 2CO2 + 2H2O

A given volume of nipa sap contains 69. 0 g of glucose. If all of this sugar is fermented , how many grams of acetic acid would be produced?

2. How many molecules of oxygen are produced when 29. 2 g of water is decomposed forming hydrogen gas and oxygen gas?

3. Hydrofluoric acid, HF(aq), cannot be stored in glass bottles because compounds called silicates in the glass are attacked by the HF(aq). Sodium silicate(Na2SiO3), for example reacts as follows:

Na2SiO3(s) + 8 HF(aq) H2SiF6(aq)

+ 2NaF(aq)

+ 3H2O(l)

a. How many moles of HF are needed to react with 0. 300 mol Na2SiO3?

b. How many grams of NaF form when 0. 500 mol of HF reacts with excess sodium silicate?

How many grams sodium silicate can react with 0. 800 g of HF?

4. Automotive air bags inflate when sodium azide, NaN3, rapidly decomposes to its component elements: 2 NaN3(s) 2Na(s) + 3N2 (g) a. How many moles of N2 are produced by the decomposition of 2. 50 mol NaN3? b. How many grams of NaN3 are required to form 6. 00 g of nitrogen gas?

5. The complete combustion of octane, C8H18, a component of gasoline, proceeds as follows: 2C8H18(l) + 25 O2 (g) 16 CO2(g) + 18 H2O(g) a. How many moles of O2 are needed to burn 0. 750 mol of C8H18? b. How many grams of O2 are needed to burn 5. 00 g of C8H18 ?

6. Detonation of nitroglycerin proceeds as follows: 4C3H5N3O9 (l) 12 CO2(g) + 6N2(g) + O2(g) + 10H2O (g)

a) If a sample containing 3. 00 mL of nitroglycerin (d = 1. 592 g/ml) is detonated, how many total moles of gas are produced?

b) How many grams of N2 are produced in the detonation? Limiting Reagents and Excess Reagents 1. Sodium chloride can be prepared by the reaction of sodium metal with chlorine gas. 2Na(s) + Cl2(g) 🡪 2NaCl(s)

a. If 6. 70 mol Na reacts with 3. 20 mol Cl2 what it the limiting reagent? b. How many moles of NaCl are produced?

How much of the excess reagent remains unreacted?

2. Phosphorus trichloride, PCl3 is commercially important compound used in the manufacture of pesticides, gasolines, additives, and number of other products. It is made by the direct combination of phosphorus and chlorine. P4 + 6Cl2 🡪 4PCl3 What mass of PCl3 forms in the reaction of 125 g P4 with 323 g Cl2?

3. Sodium hydroxide reacts with carbon dioxide as follows; 2NaOH(s) + CO2 (g) 🡪 Na2CO3 (s) + H2O (l)

a. Which reagent is a limiting reactant when 1. 70 mol NaOH and 1. 00 mol CO 2 are allowed to react?

b. How many moles of Na2CO3 can be produced?

How many moles of the excess reactant remain after the completion of the reaction?

1. The fizz produced when Alka-Seltzer tablet is dissolved in water is due to the reaction between sodium bicarbonate (NaHCO3) and citric acid (H3C6H5O7) : 3NaHCO3 (aq) + H3C6H5O7 (aq) 🡪 3CO2(g) + 3H2O(l) +

Na3C6H5O7(aq) In a certain experiment 1. 00 g of sodium bicarbonate and 1. 00 g of citric acid are allowed to react. a. Which is the limiting reactant?

b. How many grams of carbon dioxide form?

How many grams of excess reactant remained after the limiting reactant is completely consumed?

2. One of the steps in the commercial process for converting ammonia to nitric acid is conversion of NH 3 to NO: 4NH3 (g) + 5O2 (g) 4NO(g) + 6H2O(g) In a certain experiment, 2. 25 g of NH3 reacts with 3. 75 g of O2. a. Which is the limiting reactant

b. How many grams of NO forms?

How many grams of excess reactant remain after the limiting reactant is completely consumed?

3. Solutions of sodium carbonate and silver nitrate react to form solid silver carbonate and a solution of silver nitrate. A solution containing 6. 50 g sodium carbonate is mixed with one containing 7. 00 g silver nitrate. How many grams of sodium carbonate, silver nitrate, silver carbonate, and sodium nitrate are present after the reaction is complete

4. Solutions of sulfuric acid and lead(II) acetate react to form solid lead(II) sulfate and a solution of acetic acid. If 7. 50 g of sulfuric acid and 7. 50 g of lead(II) acetate are mixed, calculate the number of grams of sulfuric acid, lead(II) acetate, lead(II) sulfate, and acetic acid present in the mixture after the reaction is complete.

5. Turpentine, a hydrocarbon commonly used as paint thinner, burst into flame when warmed and place in contact with chlorine. C10H16 + Cl2 HCl + 10C a) How many moles of HCl are formed from 0. 025 mole C10H16?

b) How many moles of Cl2 are required to react with 3. 6 g C10H16?

c) Calculate the mass of C produced when the amount of C10H16 given above in (b) reacts with Cl2? d) Calculate the number of C atoms produced in (b).

6. Copper is obtained from copper ores by roasting and smelting. The process may be represented by the overall equation: 2CuFeS2 + 5O2 2Cu + 2FeO +4SO2

a) What mass of copper may be obtained from 100 kg of CuFeSs?

b) How many moles of O2 would be required for the reaction?

c) Calculate the number of molecules of SO2 that would be produced?

7. The ozone hole in the Antartic is growing. Chlorofluorocarbons (CFC) produced by humans and used as coolants in air conditioners and refrigerators have been pointed at as the culprits. One such CFC compound is dichlorodifuoromethane or Freon-12. A reaction involved in the production of Freon-12 is as follows: CCl4 + SbF3 CCl2F2 + SbCl2 F a) Determine the mass in grams of CCl4 required to completely react with 25. 75 g of SbF3. b) Calculate the mass in grams and the number of molecules of Freon-12 (CCl2F2) that would be produced from the reaction.

8. Aspirin, C9H8O4 is prepared from the reaction of salicylic acid (C 7H6O3) and acetic anhydride (C4H6O3). The reaction is C7H6O3 + C4H6O3 C9H8O4 + C2H4O2 If 40 grams of salicylic acid and 150 grams of acetic anhydride were allowed to react, a) What mass of aspirin would be produced?

b) Which is the limiting reactant?

c) Which is the reactant present in excess?

d) What mass of the reactant in excess remains unreacted?

Theoretical Yield, Actual Yield, and Percentage Yield 1. Wine is produced by the fermentation of fruit sugars to alcohol. The chemical reaction is C6H12O6 → 2CH3CH2OH + 2CO2 Five kilograms of banana pulp containing 625 grams of fructose was used in preparation of banana wine. What is the percentage yield if, at the end of fermentation 218 g of ethanol was produced?

2. Tuba is an alcoholic drink produced by the spontaneous fermentation of sap collected from coconut inflorescence. Yeasts convert sucrose and other sugars to alcohol. The conversion of sucrose to ethanol may be represented by the chemical equation: C12H22O11 + H2O → 4 CH3CH2OH + 4 CO2 Coconut sap contains 16. 5 grams/100 mL C12H22O11. What volume of sap must a tuba gatherer collect to produce tuba containing 598 g of alcohol, CH 3CH2OH, if the efficiency of the fermentation process is 66. 7 percent?

3. A 15. 6 gram sample of C6H6 is mixed with excess HNO3. We isolate 18. 0 grams of C6H5NO2. What is the percent yield of C6H5NO2? C6H6 + HNO3 → C6H5NO2 + H2O

Determination of Molecular Formula Using Combustion Analysis 1. A 0. 1014 gram sample of purified glucose was burned in a C-H combustion train to produce 0. 1468 gram of CO2 and 0. 0609 gram of H2O. An elemental analysis showed that glucose contains only carbon, hydrogen and oxygen. Determine the masses of C, H and O in the sample. Determine the EF and MF.

2. Complicated chemical reactions occur at hot springs on the ocean floor. One compound obtained from such hot spring consists of Mg, Si, H, and O. From a 0. 334 gram sample, the Mg is recovered as 0. 115 g of MgO; H is recovered as 25. 7 mg of H2O; and Si is recovered as 0. 172 g of SiO 2. What is the simplest formula of this compound?

Sequential Reactions 1. Consider the two step process for the formation of tellurous acid described by the following equations: 3TeO2 + 2OH ? TeO3 + H2O 2+ TeO3 + 2H ? H2TeO3 What mass of H2TeO3 would be formed from 62. 1 g of TeO2, assuming 100% yield?

2. Consider the formation of cyanogens, C2N2, and its subsequent decomposition in water given by the equations 2+ 2Cu + 6CN ? 2[Cu(CN)2] + C2N2 C2N2 + H2O ? HCN + HOCN How much cyanic acid, HCN, can be produced from 10. 00 g of KCN, assuming 100% yield?

3. What mass of potassium chlorate would be required to supply the proper amount of oxygen needed to burn 35. 0 g of methane, CH4? 2 KClO4 ? 2KCl + 3O2 CH4 + 2O2 ? CO2 + 2H2O