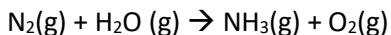


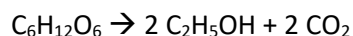
SL midterm review

1. Consider the following reaction

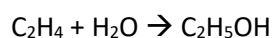


- a. Balance the reaction
 - b. Determine the Molar masses of each reagent and each product
 - c. If 13 g of N_2 reacts with 28.0g of H_2O , which is the limiting reagent?
 - d. Which is in excess?
 - e. If 14.5g of NH_3 is isolated, what's the % yield?
2. Calculate the mass of each compound
 - a. 0.0054 mol of aluminum carbonate
 - b. 9.45 moles of calcium oxide
 3. If 13.5 g of NH_3 is isolated in a flask at a pressure of 2.25 bar, what will the density of the gas temperature of 20°C be?
 4. 164.00 g of sodium hydroxide are dissolved in 350.0 mL of water. Find the molarity.
 5. 280.0 mL of 3.00 M HCl react with 68.5 g of zinc in a single replacement reaction. Determine the percentage yield of this reaction if it produces 0.644 g of hydrogen gas.
 6. Every year almost 80 million tonnes of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is produced industrially.

A method to prepare ethanol is the bacterial fermentation of sugars such as glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) according to the reaction below. The sugars are derived from plants grown for this purpose (eg. Sugar cane, beets, corn)



Ethanol is also synthesized from the chemical reaction of ethylene (C_2H_4) and water. The ethylene is prepared by heating components of natural gas and petroleum at very high temperatures and pressures.



- a. Calculate the molecular masses of each of the reagents and products in the two chemical equations presented

- b. Calculate the OAE for each reaction taking C_2H_5OH as the desired product.
 - c. Calculate the E factor for both reactions
7. Name a principle of green chemistry and provide an example!
8. Which atom has the most neutrons?
- a. ^{55}Mn
 - b. ^{58}Ni
 - c. 1H
 - d. ^{59}Co
9. Copper has two naturally occurring isotopes. Cu-63 has an atomic mass of 62.9296 amu and an abundance of 69.15%. What is the atomic mass of the second isotope?
10. Answer the following mass spectrum problem given the following natural abundances for antimony trifluoride, SbF_3 . ^{121}Sb : 57%, ^{123}Sb : 43%, ^{19}F : 100%
- a. How many signals appear in the mass spectrum of SbF_3 ?
 - b. What mass values do these signals appear at?
 - c. Sketch a mass spectrum labelling all axis's given your answers to part a and b. Sketch all necessary signals on the diagram with the correct qualitative relative intensities. Assume no fragmentation occurs (we are only considering the isotopes provided in the question)

11. A balloon filled with F_2 (F , $Z=9$) at temperature of $40^\circ C$ has a volume of 1.9L. Under a constant external pressure of 105kPa, the balloon is cooled to $-95^\circ C$.
- a. What is the volume of F_2 gas in the balloon at the lower temperature?

 - b. Compared to F_2 molecules an equal number of Ne ($Z=10$) molecules at the same temperature.
 - i. Exert less pressure because they have lower mass
 - ii. Have the same kinetic energy because they move at the same speed
 - iii. Occupy a smaller volume because they are smaller
 - iv. Have a higher average speed because they have lower mass

 - c. The graph below represents the distribution of speeds of F_2 gas at $250^\circ C$. On the same graph qualitatively sketch the expected distribution of speeds for the same amount of Ne at the same temperature. No calculations required.