

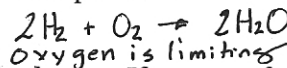
General Information $N_A = 6.022 \times 10^{23}$ (Avogadro's Number) $R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$ **Part One: Multiple Choice (60 points)**

Select the best answer to each question. There is only one correct answer.

- Which of the following compounds is a phosphate salt?
a. MgSO_4 **b. Ag_3PO_4** c. Na_3P d. P_4O_{10} e. NaCl
- What is the mass, in grams, of 10.45 mL of ethylene glycol ($d = 1.1132 \text{ g/mL}$):
a. 11.6 g
b. 9.4 g
c. 9.387 g
d. 11.63 g
e. not enough information given to determine the mass
- In class we observed the formation of a bright yellow precipitate when a metal reacted with potassium iodide? ~~Which metal was used?~~ What metal were we testing for?
a. Pb b. Ag c. Fe d. Al e. Zn
- At room temperature, carbonic acid undergoes spontaneous decomposition to produce:
a. carbon dioxide gas and hydrogen gas
b. carbon sulfide solid and oxygen gas
c. carbon dioxide gas and liquid water
d. pure carbon dioxide
e. carbon monoxide and hydrochloric acid
- The products of the combustion of acetaldehyde (CH_3CHO) with oxygen are carbon dioxide and water. How many moles of O_2 are required to react with 2 moles of acetaldehyde?
a. 2 b. 3 c. 4 **d. 5** e. 6
 $\text{CH}_3\text{CHO} + \frac{5}{2}\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$
- What is the molar mass of ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$) – an important synthetic fertilizer?
a. 70. g/mol b. 92 g/mol c. 114 g/mol **d. 132 g/mol** e. 146 g/mol
- How many grams of sodium cyanide (NaCN) can be produced from the double displacement (metathesis) reaction between 174 g $\text{Ca}(\text{CN})_2$ and excess sodium chloride:
a. 185 g
b. 46.1 g
c. 68.7 g
d. none of the above
 $\text{Ca}(\text{CN})_2 + 2\text{NaCl} \rightarrow 2\text{NaCN} + \text{CaCl}_2$
 $174 \text{ g } \text{Ca}(\text{CN})_2 \times \frac{1 \text{ mol}}{92.1} \times \frac{2 \text{ NaCN}}{1 \text{ Ca}(\text{CN})_2} \times \frac{49.01 \text{ g}}{\text{mol}} = 185 \text{ g}$
- What is the volume of 145 grams of oxygen gas at STP?
a. 22.4 L b. 203 L c. 6.43 L d. 3250 L **e. 102 L**
 $\frac{145}{32} \times \frac{22.4 \text{ L}}{\text{mol}} =$
- Which substance contains the most **atoms** in a 5.00 gram sample?
a. Br_2 b. Na_2S c. H_2O d. $\text{HC}_2\text{H}_3\text{O}_2$ **e. CH_4**
- 7.84 grams of water were produced in the combustion of 14.0 grams of ethylene (C_2H_4). The percent yield is:
a. 8.71% **b. 43.6%** c. 87.1% d. 56.0% e. none of these
 $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$
 $14.0 \text{ g} \times \frac{1 \text{ mol}}{28.06} \times \frac{2 \text{ H}_2\text{O}}{1 \text{ C}_2\text{H}_4} \times \frac{18.02 \text{ g}}{\text{mol}} = 17.98 \text{ g}$
 $\frac{7.84 \text{ g}}{17.98 \text{ g}} \times 100\% = 43.6\%$

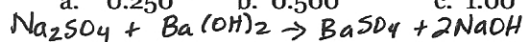
11. If 50.0 g of O_2 are mixed with 50.0 g of H_2 and the mixture is ignited, what mass of water is produced?

- a. 50.0 g (b) 56.3 g c. 65.7 g d. 71.4 g e. 100.0 g



12. Potassium bicarbonate decomposes to produce potassium carbonate, carbon dioxide and water. If 400.0 g of potassium bicarbonate are heated what is the theoretical number of moles of potassium carbonate produced?

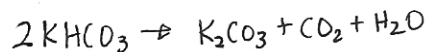
- a. 0.250 b. 0.500 c. 1.00 (d) 2.00 e. 25.0



$$400.0g \times \frac{1mol}{100.12g} \times \frac{1K_2CO_3}{2KHCO_3}$$

13. $Fe_2(SO_4)_3 + 3Ba(OH)_2 \rightarrow 3BaSO_4 + 2NaOH$, which product is a solid precipitate?

- (a) barium sulfate b. sodium hydroxide c. both d. neither



14. What gas is produced when zinc is reacted with hydrochloric acid?

- a. carbon dioxide b. water vapor c. oxygen (d) hydrogen e. chloride

15. What type of reaction takes place between zinc and hydrochloric acid?

- a. synthesis b. decomposition c. combustion (d) single displacement e. metathesis

Part Two: Short Answer (10 points)

Write your answer in the space provided

Name the following chemicals

1. $NaHCO_3$ Sodium Bicarbonate
2. KI Potassium Iodide
3. H_2SO_4 Sulfuric Acid
4. NH_3 Ammonia
5. $NaOH$ Sodium Hydroxide

Write formulas for:

1. Fluorine gas F_2
2. Carbon dioxide CO_2
3. Water H_2O
4. Copper (II) chloride $CuCl_2$
5. Calcium carbonate $CaCO_3$

Part Three: Terminology (10 points)

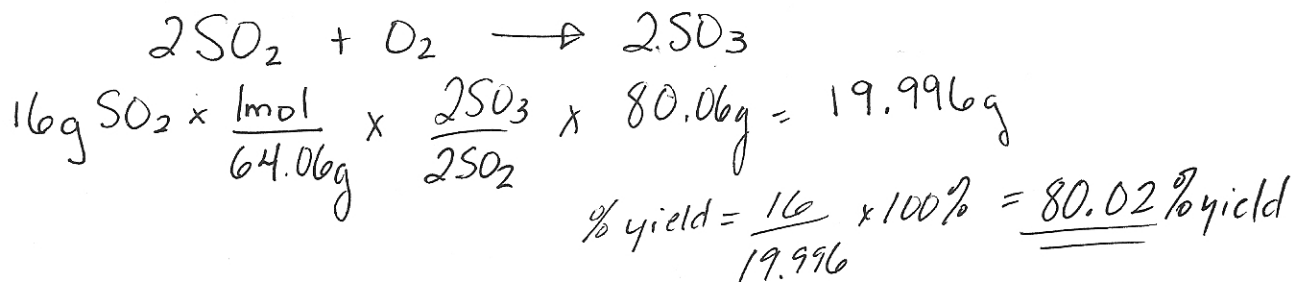
Please explain the following terms:

1. Electrolyte - a solution that conducts electricity due to the presence of ions.
2. Activity Series - a ranking of metals based on the tendency to displace another metal ion from a compound.
3. Precipitate - a solid substance formed in solution; an insoluble compound
4. Metathesis Reaction - also known as double displacement; a type of reaction where metal ions swap positions
5. Aqueous Solution - a mixture of a solute and water

Part Four: Problem Solving (20 points)

Solve the following problems. Show your work and circle your final answer.

1. Sulfur trioxide, SO_3 , is made from the reaction of SO_2 with oxygen. If 16 g of SO_2 produces 16 g of SO_3 what is the percent yield for this reaction? Show the balanced reaction and your calculations.



2. Write the balanced combustion reaction for octane (C_8H_{18}). Calculate the volume of carbon dioxide produced at STP from 1.00 L of octane ($d = 0.703 \text{ g/mL}$)

