

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 the test intended to detect?
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
- 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
- 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
- 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

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
13. $Na_2SO_4 + Ba(OH)_2 \rightarrow BaSO_4 + 2NaOH$, 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. $NaHCO_3$
2. KI
3. H_2SO_4
4. NH_3
5. NaOH

Write formulas for:

1. Fluorine gas
2. Carbon dioxide
3. Water
4. Copper (II) chloride
5. Calcium carbonate

Part Three: Terminology (10 points)

Please explain the following terms:

1. Electrolyte
2. Activity Series
3. Precipitate
4. Metathesis Reaction
5. Aqueous Solution

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 ($d = 0.703 \text{ g/mL}$)

