

PLEASE ANSWER IN THE SPACE PROVIDED. SHOW **ALL** WORK WHEREVER POSSIBLE- ESPECIALLY STOICHIOMETRIC FACTORS AND UNIT CONVERSIONS. THERE WILL BE ABSOLUTELY NO TALKING DURING THIS EXAM PERIOD. IF YOU HAVE A QUESTION, RAISE YOUR HAND. IF YOU FINISH EARLY, BRING YOUR EXAM TO ME AND LEAVE QUIETLY. DURING THE LAST TEN MINUTES OF THE EXAM PERIOD, DO NOT LEAVE YOUR SEAT AND DO NOT SPEAK TO OTHERS UNTIL ALL PAPERS HAVE BEEN COLLECTED. INITIAL EACH PAGE SO THAT IF THE PAGES BECOME SEPARATED I CAN PIECE YOUR EXAM BACK TOGETHER. USE A PEN. FILL YOUR STUDENT ID NUMBER IN THE SPACE PROVIDED. GOOD LUCK.

Selected equations, constants, and information:

$M_1V_1=M_2V_2$, $1\text{J} = 1\text{ kg m}^2\text{ s}^{-2}$, $4\text{ qts} = 1\text{ gal}$, $1.057\text{ qts} = 1\text{L}$, $4.184\text{ J} = 1\text{ cal}$, $2.54\text{ cm} = 1\text{ in}$,
 $2000\text{ lbs} = 1\text{ ton}$, $5280\text{ ft} = 1\text{ mile}$, $453.6\text{ g} = 1.00\text{lb}$, $12 = \text{dozen}$, $101.325\text{ kps} = 1\text{ atm}$, $1.00\text{ troy oz.} = 1.10\text{ avoirdupois [ordinary] oz.}$, $16.0\text{ avoirdupois oz.} = 1.00\text{ avoirdupois pound}$,
 $R=0.08206\text{L atm/K mol}$, $1\text{atm}=29.92\text{ in}=760\text{torr}=760\text{mm Hg}$

Soluble compounds	Insoluble compounds
compounds of Group 1 elements	carbonates, chromates, and phosphates, except those of the Group 1 elements and NH_4^+
ammonium compounds	
chlorides, bromides, and iodides, except those of Ag^+ , Hg_2^{2+} , and Pb^{2+} *	sulfides, except those of the Group 1 and 2 elements and NH_4^+
nitrates, acetates, chlorates, and perchlorates	hydroxides and oxides, except those of the Group 1 and 2 elements**
sulfates, except those of Ca^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+} , Hg_2^{2+} , and Ag^{+} ***	

* PbCl_2 is slightly soluble.

** $\text{Ca}(\text{OH})_2$ and $\text{Sr}(\text{OH})_2$ are sparingly (slightly) soluble; $\text{Mg}(\text{OH})_2$ is only very slightly soluble.

*** Ag_2SO_4 is slightly soluble.

I. Nomenclature (15pts)

Place the proper chemical formula for each name in the blank provided.

1) iron (III) phosphate

2) lithium sulfide

3) potassium nitrite

4) calcium oxide

5) silicon dioxide

6) potassium permanganate

7) sulfide ion

Give the name for each chemical formula.

8) SO_3

9) CuSO_4

10) K_2CO_3

11) MnS

12) ZnO

13) $(\text{NH}_4)_3\text{PO}_4$

14) CO

15) MgBr_2

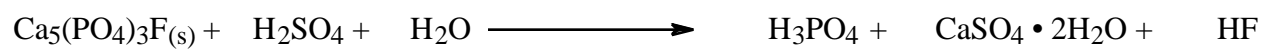
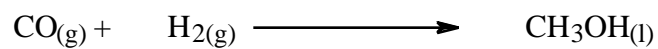
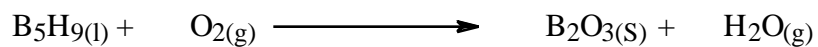
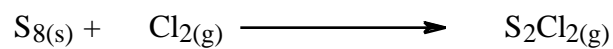
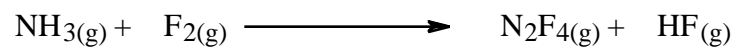
II. Vocabulary (10pts) Place the most appropriate term in the blank provided.

Chemistry is the study of the properties and interactions of matter. Matter is found in two principal forms, either ionic or _____. Matter that is ionic is made up of _____, which are positively charged, and _____ which bear a negative charge. Together, these ions combine in definite whole number ratios to form _____. When an ionic compound is _____ in water, the ions which make up the compound are separated by water molecules and are spread throughout the water. The water in this case is called the _____ because it is dissolving the ionic compound which must therefore be called the _____ or the substance being dissolved. When comparing two solutions, the solution which contains more solute per unit volume is said to be more _____. One unit of concentration is molarity. Molarity is defined as the moles of _____ per liter of _____.

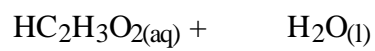
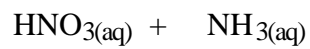
III. Complete the following problems (40pts).

- 1) When elemental nitrogen and elemental oxygen react in the cylinder of an automobile engine, nitrogen monoxide is formed. After it escapes into the atmosphere with other exhaust gases, the nitrogen monoxide reacts with elemental oxygen to produce nitrogen dioxide. Write the two balanced equations leading to the formation of nitrogen dioxide.

2) Balance the following chemical equations.



3) Complete and balance the following chemical equations.



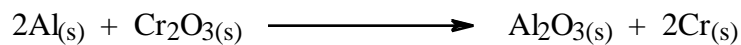
4) Determine the number of atoms in 18.3 μg of Sc.

5) Aspartame ($C_{14}H_{18}N_2O_5$) is an artificial sweetener sold as NutraSweet. How many molecules are present in 1.0mg of aspartame?

6) A chemist believes that she has synthesized L-dopa, a drug used to treat Parkinson's disease. After elemental analysis the compound in question is found to be 54.82% carbon, 5.62% hydrogen, and 7.10% nitrogen. What is the empirical formula for the compound synthesized?

7) You are asked to prepare 25.00mL of 0.155M $\text{AgNO}_3(\text{aq})$. To do this, what mass of AgNO_3 must be placed into a 25.00mL volumetric flask and dissolved and diluted to the mark with distilled water?

8) Give oxidation numbers for each of the atoms in the following chemical equation. Show which species are oxidized and which are reduced. Identify the oxidizing agent and the reducing agent for the reaction shown below by placing the formula for each in the blank provided.



Oxidizing agent_____

Reducing agent_____

IV. Essay (20pts)

1. The British chemist Michael Faraday gave Christmas lectures to children in the mid-nineteenth century. One of his lectures involved investigating what he called the “chemical history of a candle.” He would light a candle, then examine the colors and the smoke given off. He weighed the candle before and after burning to see if it lost mass, and it did. He would hold a mirror over it to catch condensation of water and soot. Then he would place a glass tube into the flame and show that thick, white fumes came out. He suggested that the fumes might be candle wax that had been vaporized by the heat. To check for the validity of that suggestion, he lit the fumes and they did indeed burn. Categorize each of Faraday’s suggestions and actions as observation, measurement, hypothesis, experiment, or theory.

Suggestion or Action	Category

2. If you were a "tiny little person" and could see on the molecular and atomic level, you might be able to see what chemical species were present in solutions and how chemical reactions occurred. Assume you are a "tiny little person" and draw the reactants and products in three separate beakers for the reaction of $\text{Pb}(\text{NO}_3)_2$ and K_2SO_4 . You should show two beakers containing the individual reactants and one depicting the products. Give the complete balanced chemical equation for the reaction as well as the net ionic equation if there is one.

V. Laboratory (15pts)

The following data were obtained experimentally to determine the density of an unusually dense pure liquid compound. A buret was used to add an amount of the liquid to a glass bottle. However, prior to the first addition, the student forgot to record the mass of the bottle. Complete the table, make a graph of total mass versus total volume delivered, compute the mass of the empty bottle into which the liquid was added and compute the density of the liquid from the graph. The initial buret reading was 0.46 mL. Graph paper may be found on the next page.

Data Point	Buret Reading (mL)	Total Volume Delivered	Total Mass (g)
1	25.57		126.189
2	29.89		137.152
3	31.64		141.597
4	35.40		151.148
5	38.28		158.463