CHEM 1314.03
Exam I
John I. Gelder
September 25, 1997

Name _____

TA's Name _____

Lab Section _____

Please sign your name below to give permission to post, by the last 4 digits of your student I.D. number, your course scores on homework, laboratories and exams. If you do not sign no scores will be posted.

_____
(signature)

INSTRUCTIONS:

1. This examination consists of a total of 6 different pages. The last two pages include a periodic table and some useful equations. All work should be done in this booklet.

2. PRINT your name, TA's name and your lab section number now in the space at the top of this sheet. DO NOT SEPARATE THESE PAGES.

3. Answer all questions that you can and whenever called for show your work clearly. Your method of solving problems should pattern the approach used in lecture. You do not have to show your work for the multiple choice or short answer questions.

4. No credit will be awarded if your work is not shown in problems 4a, 4d, and 4e.

5. Point values are shown next to the problem number.

6. Budget your time for each of the questions. Some problems may have a low point value yet be very challenging. If you do not recognize the solution to a question quickly, skip it, and return to the question after completing the easier problems.

7. Look through the exam before beginning; plan your work; then begin.

8. Relax and do well.

	Page 2	Page 3	Page 4	Page 5	TOTAL
SCORES	_____	_____	_____	_____	_____
	(33)	(27)	(17)	(23)	(100)

(12) 1. Write the chemical formula(s) of the product(s) and balance the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous.

a) calcium nitrate*(aq)* + sodium phosphate*(aq)* $\rightarrow$

b) $P_{4(s)} + O_{2(g)} \xrightarrow{\Delta}$

c) $C_5H_{11}OH_{(l)} + O_{2(g)} \xrightarrow{\Delta}$

d) sulfuric acid*(aq)* + zinc*(s)* $\rightarrow$

(9) 2. Perform the following calculations and give the answer to the correct number of significant figures.

a) $3.1416 \cdot (1.30)^2 =$

b) $2.97 \times 10^2 + 8.78 \times 10^4 =$

c) $7.966 + 3.046 \times 10^2\left(\frac{1}{273.15} - \frac{1}{283}\right) =$

(12) 3. Complete the following table

Formula	*M*, Molar Mass $\left(\frac{g}{mol}\right)$	*m*, mass of sample (gms)	*n*, moles of sample (mol)	*N*, number of molecules, or formula units
AgS		0.0459		
$C_7H_5BiO_4$			1.75×10^3	
$C_2X_2H_8$		150.		1.50×10^{24}

What is the symbol (or name) of the unknown element, X?

(27) 4. A particular compound is found to be 27.38% Na, 14.29% C, 57.14% O and 1.20% H.

a) Determine the empirical formula for this compound.

b) Is this compound ionic or covalent? Explain.

c) What is the correct name of this compound?

d) A sample of this compound with the dimensions 0.25 inches by 0.25 inches by 0.45 inches weighs 3.51×10^{-2} oz. Determine the density of the compound in $g \cdot mL^{-1}$.

e) What is the mass, in grams, of one formula unit of this compound?

g) Write the balanced chemical equation describing the reaction which occurs when this compound, in its standard state phase, is added to an aqueous solution of hydrochloric acid.

(6) 5. Predict a reasonable formula for the binary compound formed from each of the following combinations of elements.

a) calcium and iodine

b) sulfur and hydrogen

c) carbon and chlorine

(11) 6. Each element in the periodic table on the last page of this examination has two numbers associated with it. Provide the proper term for each number and explain how each number is determined.

(8) 7. Complete the following table;

Name of the compound	Formula of the compound	Ionic or Covalent Compound
	$HCN_{(g)}$	
magnesium hydroxide		
	PCl_5	
sodium nitride		

Multiple Choice: (15 points)

Print the letter (A, B, C, D) which corresponds to the answer selected.

8. _____ 9. _____ 10. _____ 11. _____ 12. _____

ONLY THE ANSWERS IN THE AREA ABOVE WILL BE GRADED. Select the most correct answer for each question. Each question is worth 3 points.

8. A series of compounds containing sodium, chlorine and oxygen have the general formula $NaClO_n$. One of these compounds is 28.96% chlorine. What is the correct formula for this compound?

A) NaClO B) $NaClO_2$ C) $NaClO_3$ D) $NaClO_4$ E) $NaClO_5$

9. Which of the following sets of substances contain the same number of electrons?

A) Cl^{-1}, Ar, Ca^{2+}
B) F^{-1}, Cl^{-1}, I^{-1}
C) Fe^{2+}, Fe^{3+}, Fe^{4+}
D) O^{-2}, Ne, Li^{1+}

10. Which of the following is the higher temperature?

A) 230 K B) –25 ˚F C) –25 ˚C D) –40 ˚F

11. Which of the following has the greatest number of oxygen atoms?

A) 0.250 moles of HNO_3
B) 2.450 grams of $Al_2(SO_4)_3$
C) 3.00×10^{23} molecules of H_2O
D) 3.00 gms $CuSO_4 \cdot 5H_2O$

12. Which of the following has highest percentage of nitrogen by weight?

A) NO B) NO_2 C) N_2O D) N_2H_4 E) Mg_3N_2

Periodic Table of the Elements

	IA												IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.008	IIA																2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
3	11 **Na** 22.99	12 **Mg** 24.30	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.38	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
5	37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
6	55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** 226.0	89 **Ac** 227.0	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)									

Lanthanides	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.2	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0
Actinides	90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** 237.0	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Useful Information

1 pound (lb) = 453.59237 gram (gm)

1 liter (L) = 1.056718 quart (qt)

4 qt = 1 gallon (gal)

1 inch (in) = 2.54 centimeters (cm)

1 mile = 5280 feet (ft)

$^{\circ}C = \frac{5}{9}(^{\circ}F - 32)$

density of water = $1.00 \frac{g}{mL}$

$K = {}^{\circ}C + 273.15$

average atomic mass = Σ(isotopic mass $\cdot$ fractional abundance)

Avogadro's number = 6.022×10^{23}

(3) a) Determine its molar mass.

(9) b) Determine the percent by mass of each of the elements in the compound.

(2) c) What is the name of the compound?

(4) d) How many atoms of oxygen are in one formula unit of the compound?

(4) e) How many moles of the compound are contained in 2.450 grams of $Al_2(SO_4)_3$

(6) f) What mass of Na_2SO_4 contains the same number of formula units as 125 gms of $Al_2(SO_4)_3$?
d) How many moles are contained in 12.5 g of this compound?

f) What is the mass of this compound which contains 4.92×10^{24} atoms of oxygen?