CHEM 1215
Exam II
John II. Gelder
October 13, 1999

Name _____

TA's Name _____

Lab Section _____

INSTRUCTIONS:

1. This examination consists of a total of 5 different pages. The last page includes a periodic table and a solubility table. 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 (if any) or short answer questions.

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

5. 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.

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

7. Relax and do well.

	Page 2	Page 3	Page 4	TOTAL
SCORES	_____ (36)	_____ (48)	_____ (16)	_____ (100)

(18) 1. Complete the following table by inserting the name of the compound or the formula.

Compound Name	Formula
sulfuric acid	**$H_2SO_{4(aq)}$**
Dinitrogen trioxide	N_2O_3
Hydrobromic acid	$HBr_{(aq)}$
Hydrogen peroxide	**H_2O_2**
Acetic acid	**$HC_2H_3O_2$**
Sodium hydrogen carbonate	**$NaHCO_3$**
Potassium chlorate	$KClO_4$
Tetraphosphorus decaoxide	**P_4O_{10}**
	$FePO_4$

(7) 2. When solid barium hydroxide is added to solid ammonium chloride and mixed a wet slush containing aqueous barium chloride and water, and smelling of ammonia is produced. Write a balanced chemical equation from this description. Be sure to include the phase for each substance.

$$\mathbf{Ba(OH)_2(aq) + 2NH_4Cl(aq) \rightarrow BaCl_2(aq) + 2NH_3(g) + 2H_2O(l)}$$

(11) 3. Predict the solubility of the following compounds in water. For those soluble compounds write the formula for the cation and anion that exists in aqueous solution.

a) $CuCl_2$ **soluble**
Cu^{2+} Cl^-

b) $KMnO_4$ **soluble**
K^+ MnO_4^-

c) HNO_3 **soluble**
H^+ NO_3^-

d) $BaSO_4$ **insoluble**

(36) 4. 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) $\mathbf{2}Na(s) + \mathbf{2}H_2O(l) \rightarrow 2\mathbf{NaOH(aq)} + \mathbf{H_2(g)}$

b) $HCl(aq) + Ba(OH)_2(aq) \rightarrow \mathbf{BaCl_2(aq)} + \mathbf{2H_2O(l)}$

c) $NH_3(aq) + H_2SO_4(aq) \rightarrow \mathbf{(NH_4)_2SO_4(aq)}$

d) $\mathbf{2}Fe(NO_3)_3(aq) + \mathbf{3}Na_2S(aq) \rightarrow \mathbf{Fe_2S_3(s)} + \mathbf{6NaNO_3(aq)}$

e) $\mathbf{2}H_2(g) + O_2(g) \rightarrow \mathbf{2H_2O(g)}$

f) $\mathbf{2}C_4H_{10}(l) + \mathbf{13}O_2(g) \rightarrow \mathbf{8CO_2(g)} + \mathbf{10H_2O(l)}$

g) $\mathbf{2}K(s) + Br_2(l) \rightarrow \mathbf{2KBr(s)}$

h) $Mg(s) + \mathbf{2}HNO_3(aq) \rightarrow \mathbf{Mg(NO_3)_2(aq)} + \mathbf{H_2(g)}$

i) $Na_2CO_3(s) + HCl(aq) \rightarrow \mathbf{2NaCl(aq)} + \mathbf{H_2O(l)} + \mathbf{CO_2(g)}$

(12) 5. Write the balanced ionic and balanced net ionic chemical equations for 1d) and one other choosing from 1a, 1b or 1i. (Remember to include the correct charges on all ions and the phase of each species.)

1d)

Ionic equation:

$$\mathbf{2Fe^{3+}(aq) + 6NO_3^-(aq) + 3S^{2-}(aq) + 6Na^+(aq) \rightarrow 6Na^+(aq) + 6NO_3^-(aq) + Fe_2S_3(s)}$$

Net Ionic equation:

$$\mathbf{2Fe^{3+}(aq) + 3S^{2-}(aq) \rightarrow Fe_2S_3(s)}$$

1a, 1b or or 1i)

Ionic equation:

$$\mathbf{2Na(s) + 2H_2O(l) \rightarrow 2Na^+(aq) + 2OH^-}\mathbf{\textit{(aq)}} \mathbf{+ H_2}\mathbf{\textit{(g)}}$$

Net Ionic equation:

$$\mathbf{2Na(s) + 2H_2O(l) \rightarrow 2Na^+(aq) + 2OH^-}\mathbf{\textit{(aq)}} \mathbf{+ H_2}\mathbf{\textit{(g)}}$$

(8) 6a. Briefly define a chemical reaction. List at least three 'driving forces' which are common to chemical reactions.

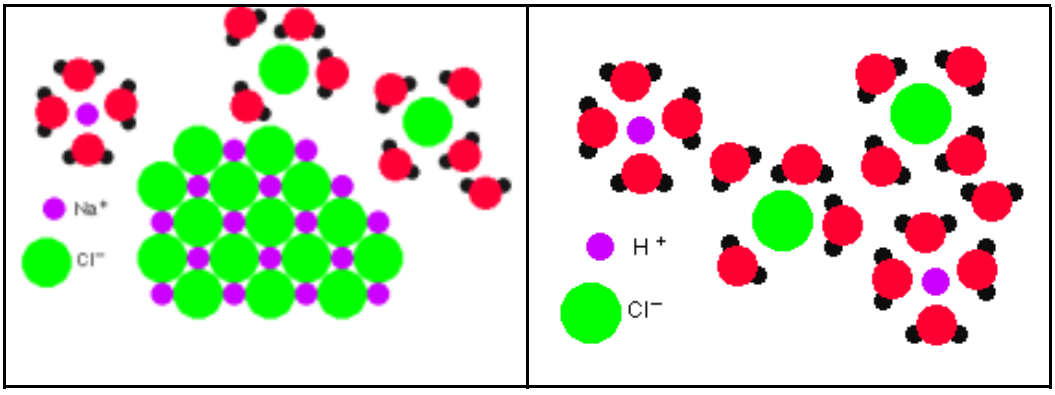
A chemical reaction involves the conversion of one or more reactants to products which are chemically different, i.e., substances with differnet combinations of elements.

Driving Forces;
1. **formation of a precipitate,**
2. **formation of a gas,**
3. **formation of water,**
4. **color change.**

b) When a soluble ionic solid is added to water it dissolves. Is this 'process' a chemical reaction? Yes or No. Briefly defend your answer.

NO. The process of a solid dissolving in water is not a chemical reaction. Ionic solids are composed of ions, when dissolved in water the ions are only hydrated. Allowing the water to evaporate, the original solid will reform. In a chemical reaction the reactants can not be obtained from a simple physical change in the system.

(8) 7. When an ionic compound like NaCl(s) is added to water we observe it dissolving. The same thing happens when HCl(g) is added to water, it dissolves. Use the space below to sketch two diagrams one depicting at the atomic level the NaCl(aq) solution and the other depicting at the atomic level the HCl(aq) solution. Clearly label the important species in your diagrams.



Periodic Table of the Elements

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.008																	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											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)

Solubility Table

Ion	Solubility	Exceptions
NO_3^-	soluble	none
ClO_4^-	soluble	none
Cl^-	soluble	except Ag^+, Hg_2^{2+}, $*Pb^{2+}$
SO_4^{2-}	soluble	except Ca^{2+}, Ba^{2+}, Sr^{2+}, Hg^{2+}, Pb^{2+}, Ag^+
CO_3^{2-}	insoluble	except Group IA and NH_4^+
PO_4^{3-}	insoluble	except Group IA and NH_4^+
CrO_4^{2-}	insoluble	except Group IA, IIA and NH_4^+
^-OH	insoluble	except Group IA, $*Ca^{2+}$, Ba^{2+}, Sr^{2+}
S^{2-}	insoluble	except Group IA, IIA and NH_4^+
Na^+	soluble	none
NH_4^+	soluble	none
K^+	soluble	none

*slightly soluble