CHEM 1215
Final Exam
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December 6, 1999

Name _____

TA's Name _____

Lab Section _____

INSTRUCTIONS:

1. This examination consists of a total of 7 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. No credit will be awarded if your work is not shown in problems 4, 5 and 7 - 9.

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	_____ (30)	_____ (30)	_____ (20)	_____ (20)	_____ (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) $HNO_{3(aq)} + Ba(OH)_{2(aq)} \rightarrow$

b) $C_6H_{14(l)} + O_{2(g)} \rightarrow$

c) $CuCl_{2(aq)} + Na_2S_{(aq)} \rightarrow$

d) $Na_2CO_{3(aq)} + H_2SO_{4(aq)} \rightarrow$

(8) 2. Write the balanced ionic and balanced net ionic chemical equations for the reactions a) and c) in Problem 1. (Remember to include the correct charges on all ions and the phase of each species.)

1a)

Ionic equation:

Net Ionic equation:

1c)

Ionic equation:

Net Ionic equation:

(10)3a. Complete the following table by inserting the name of the compound or the formula.

Compound Name	Formula
hydrochloric acid	
	N_2O_4
Ammonium phosphate	
Potassium nitrite	
	$Al(OH)_3$

(12) 4. At 25 ˚C the density of liquid water is 0.997 g cm^3, while at –10 ˚C the density of solid water is 0.917 g cm^3.

a) If a soft drink can with a volume of 250 cm^3 is completely filled with water at 25 ˚C, and then frozen at –10 ˚C, calculate the volume of the water in the can.

b) Can the can contain the ice at –10 ˚C? Explain.

(18) 5. Perform the following conversions;

a) the number of miles in 15.0 km

b) convert 38.5 ˚C to ˚F and K.

c) the area of a standard sheet of paper is 93.5 in^2, calculate the area in km^2.

(8) 6. Write the formula for the binary compound formed from the following pairs of elements. Indicate the probable phase of each compound.

a) calcium and oxygen

b) nitrogen and hydrogen

c) carbon and fluorine

d) potassium and sulfur

(12) 7. Calculate the following,

a) the <u>number</u> of P_2O_5 molecules and the number of oxygen atoms in 92.8 g of P_2O_5.

b) the <u>number</u> of hydrogen atoms in 3.8 mol $C_6H_{12}O_6$.

c) the <u>mass</u>, in grams, of a single molecule of carbon dioxide.

(8) 8. For the reaction

$$MnO_{2(s)} + 4HCl_{(ag)} \rightarrow Cl_{2(g)} + MnCl_{2(aq)} + 2H_2O_{(l)}$$

Calculate how many grams of MnO_2 that must react to produce 4.13×10^{-2} g of Cl_2. (Assume HCl is in excess.)

(12) 9. In the reaction,

$$4FeS_{2(s)} + 11O_{2(g)} \rightarrow 8SO_{2(g)} + 2Fe_2O_{3(s)}$$

156.6 g of iron(IV) sulfide are added to an amount of oxygen. After the reaction occurs 167.0 grams of SO_2 are produced. Answer each of the following,

a) the grams of Fe_2O_3 produced?

b) Could O_2 be the limiting reagent or is it in excess in this reaction? Explain. (You may use a calculation to support your answer.)

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)

$\lambda = \frac{c}{\nu}$ $E = h\nu$ $c = 3.00 \times 10^{8} \frac{m}{s}$ $h = 6.626 \times 10^{-34}$ J·s

1 nm = 1×10^{-9} m

1 pound (lb) = 453.59237 gram (gm)

1 liter (L) = 1.056718 quart (qt)

heat = mass · S.H. · ΔT

1 inch (in) = 2.54 centimeters (cm)

Specific Heat (capacity) for $H_2O = 4.184 \frac{J}{g\ ^\circ C}$

$^\circ F = \frac{9}{5}{}^\circ C + 32$

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

average atomic mass = Σ(isotopic mass · fractional abundance)

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