Chemistry 1215
Section #2
Exam IV and Final
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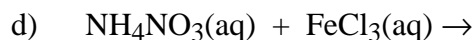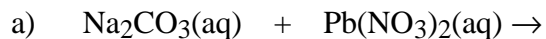May 4, 1988

Name _____

Section _____

TA's Name _____

COWBOYS

INSTRUCTIONS:

1. This examination consists of a total of 10 different pages. The problems (1 – 11) on pages 2 – 5 make–up the 4th exam, while the problems (12 – 23) on pages 6 – 8 are the final exam. The last two pages includes useful information and a periodic table. All work should be done in this booklet.

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

3. Answer all questions that you can and whenever called for show your work clearly. The approach used to solve stoichiometry problems must pattern the approach used in lecture.

4. Show your work on Problems 3, 4, 9 – 12, 20, 22 and 23.

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	4th TOTAL	Page 6	Page 7	Page 8	FINAL TOTAL
SCORES	_____ (20)	_____ (14)	_____ (8)	_____ (8)	_____ (50)	_____ (28)	_____ (25)	_____ (22)	_____ (75)

(8)   1. Complete and balance the following reactions. Using the Solubility Table, identify whether each product
           is soluble (aq) or insoluble (s).

           a) $Na_2CO_3(aq)$ + $Pb(NO_3)_2(aq) \rightarrow$

           b) $K_2S(aq)$ + $Pb(NO_3)_2(aq) \rightarrow$

           c) $Na_3PO_4(aq)$ + $Ba(NO_3)_2(aq) \rightarrow$

           d) $NH_4NO_3(aq)$ + $FeCl_3(aq) \rightarrow$

(2)   2. Complete and balance the following equations. (If no reaction occurs write NR.)

           a) $BaO(s)$ + $H_2O(l) \rightarrow$

           b) $SO_3(g)$ + $H_2O(l) \rightarrow$
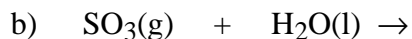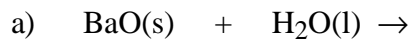
(5)   3. Calculate the volume occupied by 16.0 g of CO_2 gas at 720 mmHg and $-20\ ^{\circ}C$.

(5)   4. If a vessel with 1.38 mol of an ideal gas has a pressure of 400 mmHg, calculate the new pressure if the
           number of moles of the gas is increased to 2.16 mol. (Assume the volume and temperature are
           constant.)

(4)   5. Discuss hydrogen–bonding in water. (In your discussion include; the definition of hydrogen–bonding, a diagram of at least three water molecules and how they hydrogen–bond to each other {clearly label the hydrogen–bonds}, how hydrogen–bonding effects the boiling point of water and the density of solid and liquid water.)

(6)   6. Define vapor pressure for a liquid. Also explain, how the vapor pressure of a liquid depends on temperature, and define the boiling point of a liquid.

(4)   7. Briefly describe what happens when a small amount of NaCl is added to water. (In your discussion include; whether NaCl dissolves or not, a chemical equation for the solution process and a simple picture of what sodium chloride looks like dissolved in water <u>at the atomic level</u>.)

(4)   8. What volume of a 0.450 M HCl solution contains 3.75 moles of HCl?

(4)   9. Briefly describe how you would prepare 500 mL of a 0.800 M NaCl solution starting with a NaCl solution which is 2.50 M.

(4)   10. Calculate the weight percent and the molality of a solution prepared by adding 20.0 g of glucose ($C_6H_{12}O_6$) to 430 g of water.

(4)   11. Calculate the freezing point and the boiling point of the solution in Problem #10.

(6) 12. My office is 5.25 meters long, 4.85 meters wide and 2.75 meter high. If the density of air at room
          temperature is 1.19 g/L, calculate the mass of the air in my office.

(6) 13. Solve the following mathematical problems and state the answer to the correct number of significant
          figures. (Note: the numerical answer must be correct for credit.)

a) 302.4579 g   b) $\dfrac{296.0}{5.24}$ =   c) $\dfrac{(37.92 - 29.823) * 10.028}{4.235}$ =
   –56.63   g

(8) 14. Complete the following table.

Substance	Formula	Physical Properties
Sodium		
Hydrogen		
Lead Iodide		
Sodium hydroxide		

(2) 15. For one of the substances in Problem #14, briefly describe a chemical property as seen in lecture or
          laboratory.

(6) 16. Write the ground state electron configuration for the following species.

a) Mg

b) Cu

c) Pb

(6)   17. Complete the following table by inserting the name of a compound or a formula:

Compound Name	Formula
_____	$FeCl_3$
dinitrogen tetroxide	_____
_____	H_3PO_4
aluminum hydroxide	_____
_____	NH_4NO_3
barium phosphate	_____

(7)   18. Determine the oxidation state for each element in the following compounds

a) NaH_2PO_4 Na _____ H _____ P _____ O _____

b) $K_2Cr_2O_7$ K _____ Cr _____ O _____
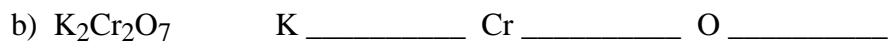
(6)   19. Draw the Lewis electron dot structure for the following molecules

a) ClO_3^-

b) CF_4

(6)   20. Trinitrotoluene (TNT) is 37.0 % carbon, 2.22 % hydrogen, 42.3 % oxygen and 18.5 % nitrogen. Determine the empirical formula for TNT.

(7) 21. Complete the following table

Formula	Molar Mass $\left(\frac{g}{mol}\right)$	Mass of Sample (g)	Moles of Sample (mol)	Number of atoms, molecules, or formula units
$C_6H_{12}O_6$		14.75		
$AlCl_3$	133.5			4.302×10^{21} formula units
unknown		20.3	0.0916	

(7) 22. How many grams of I_2 are produced by the reaction of 0.360 moles of $CuCl_2$ with excess KI?

$$CuCl_2(s) + KI(s) \rightarrow CuI(s) + KCl(s) + I_2(s)$$

(8) 23. Calculate the mass of carbon dioxide produced when 10.0 grams of propane (C_3H_8), is burned in 25.0 grams of oxygen? (Hint: This is a combustion reaction.)

Useful Information

$R = 0.0821 \dfrac{atm \cdot L}{mol \cdot K}$ $PV = nRT$

Avogadro's Number $= 6.02 \times 10^{23}$ $\Delta T = mk$ $k_f(H_2O) = 1.86 \dfrac{^\circ C}{m}$: $k_b(H_2O) = 0.52 \dfrac{^\circ C}{m}$

$\dfrac{(^\circ F - 32)}{1.8} = \ ^\circ C$

1 inch (in) = 2.54 centimeters (cm)   1 pound (lb) = 454 grams (g)

1.057 quarts = 1 liter (L)

Activity Series
Metals: K, Ca, Na, Mg. Al, Zn, Fe, Sn, Pb, H, Cu, Ag, Hg, Au
Halogens: F_2, Cl_2, Br_2, I_2

Class	Solubility in cold water
Nitrates	All nitrates are soluble.
Acetates	All acetates are soluble.
Chlorides, Bromides, Iodides	All chlorides, bromides, and iodides are soluble except those of Ag, Hg(I), and Pb(II); $PbCl_2$ and $PbBr_2$ are slightly soluble in hot water.
Sulfates	All sulfates are soluble except those of Ba, Sr, and Pb; Ca and Ag sulfates are slightly soluble.
Carbonates, Phosphates	All carbonates and phosphates are insoluble except those of Na, K, and NH_4. Many bicarbonates and acid phosphates are soluble.
Hydroxides	All hydroxides are insoluble except those of the alkali metals and NH_4OH; $Ba(OH)_2$ and $Ca(OH)_2$ are slightly soluble.
Sodium salts Potassium salts Ammonium salts	All common salts of these ions are soluble.
Sulfides	All sulfides are insoluble except those of the alkali metals, ammonium, and the alkaline earth metals (Ca, Mg, Ba).

Periodic Table of the Elements

IA																	VIIIA
1 **H** 1.008	IIA											IIIA	IVA	VA	VIA	VIIA	2 **He** 4.00
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
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
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
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
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)
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)