Chem 130 **Name_____**
Exam 1, Ch 4-6.7 **October 12, 2018**
100 Points

Please follow the instructions for each section of the exam. Show your work on all mathematical problems. Provide answers with the correct units and significant figures. Be concise in your answers to discussion questions. Any values in curly brackets {##} are molar masses in grams per mole.

Part 0: Warmup. 4 points each

1. In order to prepare 0.0500 M HCl from a 1.00 M HCl solution, you should pipet ____ mL of the 1.00 M solution into a 200.0 mL volumetric flask and dilute to the mark.
   a. 1.00
   b. 2.00
   c. 5.00 Answer _____
   d. 10.00

2. To precipitate Zn^{2+} from a solution of $Zn(NO_3)_2$, add
   a. NH_4Cl
   b. $MgBr_2$
   c. K_2CO_3 Answer _____
   d. $(NH_4)_2SO_4$

3. A bottle contains 1.0 mol hydrogen gas, 2.0 mol helium gas, 1.0 mol neon gas and 1.0 mol of solid metallic gold. If the total pressure in the bottle is 2.0 atm, what is the partial pressure of helium in the bottle?
   a. 0.20 atm
   b. 0.25 atm
   c. 0.50 atm Answer _____
   d. 1.0 atm

Part I: Complete all of problems 4-9

4. Complete the following table. (10 points)

Species	Name	Oxidation States			Water Soluble? (Y/N)
$Co(ClO_4)_3$		Co =	Cl =	O =	
$Zn_3(PO_4)_2$		Zn =	O =	P =	

5. Ammonia, NH_3, may react with oxygen to form nitrogen gas and water. If 3.65 g of NH_3 reacts with 5.48 g O_2 and produces 0.850 L of N_2, at 295 K and 1.00 atm, what is the percent yield for the reaction? H_2O {18.02}, NH_3 {17.03}, O_2 {32.00}, N_2 {28.01} (10 points)

Answer_____

6. How does the kinetic-molecular theory (KMT) of gases help explain why a helium-filled balloon shrinks if it is taken outside on a cold winter day? Use the components of the KMT in your explanation. No calculations are necessary(10 points)

7. Suppose we have a solution of lead nitrate, $Pb(NO_3)_2(aq)$. A solution of NaCl(aq) is added slowly to cause the formation of $PbCl_2(s)$ until no further precipitation occurs. The precipitate is collected, dried, and weighed. A total of 10.62 g of $PbCl_2(s)$ is obtained from 200.0 mL of the original solution. Calculate the molarity of the $Pb(NO_3)_2(aq)$ solution.
   $Pb(NO_3)_2$ {331.21}, NaCl {58.44}, $PbCl_2$ {278.11} (10 points)

Answer_____

8. A solution is prepared by diluting 71.0 mL of a 1.30 M $CaCl_2$ solution to a total volume of 268 mL. A 134-mL portion of that solution is diluted by adding 155 mL of water. What is the chloride ion concentration in the final solution? Assume the volumes are additive. $CaCl_2$ {110.98} (10 points)

Answer_____

9. Write balanced overall reactions and net ionic equations for each of the following: Indicate the state (s, l, g, aq) of each of the reactants and products. (10 points)

   a. Aqueous sulfuric acid is mixed with aqueous ammonium hydroxide

   Balanced Reaction:

   Net Ionic Equation:

   b. Aqueous lead (II) nitrate is mixed with aqueous lithium sulfide

   Balanced Reaction:

   Net Ionic Equation:

Part II. Answer three (3) of problems 10-13. Clearly mark the problem you do not want graded. 10 points each.

10. You can dissolve an aluminum soft drink can in an aqueous base such as potassium hydroxide.

$$\underset{\{26.98\}}{2\ Al\ (s)} + \underset{\{56.11\}}{2\ KOH\ (aq)} + \underset{\{18.02\}}{6\ H_2O\ (l)} \rightarrow \underset{\{134.11\}}{2\ KAl(OH)_4\ (aq)} + \underset{\{2.02\}}{3\ H_2\ (g)}$$

a. If you place 2.05 g of aluminum in a beaker with 125 mL of 1.25 M KOH, will any aluminum remain? Justify your answer with a calculation, no calculation, no credit. (6 points)

b. After the reaction is complete, what is the concentration of $KAl(OH)_4$ in moles per liter? You may assume a final solution volume of 125 mL. (4 points)

Answer_____

11. Consider the reaction of zinc metal with hydrochloric acid, as shown below. In an experiment, 2.04 grams of zinc is introduced into 25.0 mL of 2.00 M HCl. The gas that is evolved is collected over water. When the reaction is complete, 0.200 L of gas has been collected at 21°C. What is the pressure in the container when the reaction is complete?

$$\underset{\{65.41\}}{Zn(s)} + \underset{\{36.46\}}{2HCl(aq)} \rightarrow \underset{\{136.30\}}{ZnCl_2(aq)} + \underset{\{2.02\}}{H_2(g)}$$

Answer_____

12. Answer the following questions related to the combustion of ethanol. Assume the ideal gas law applies.

$$\underset{\{46.07\}}{2\ CH_3CH_2OH(l)} + \underset{\{32.00\}}{6\ O_2(g)} \rightarrow \underset{\{44.01\}}{4\ CO_2(g)} + \underset{\{18.02\}}{6\ H_2O(l)}$$

a. If 1.00 g of ethanol is burned in a 2.00 L container filled with oxygen at 2.08 atm and 80°C, how many moles of carbon dioxide are produced? (4 points)

Answer_____

b. What will be the final pressure in the container? You may ignore the contribution of water vapor. (4 points)

Answer_____

c. What volume would the gas occupy at STP? Use "old STP" of 0°C and 1 atm. (2 points)

Answer_____

13. Redox reactions:
    a. Balance the following reaction in acidic solution. (8 points)

$$BrO_3^-(aq) + H_2O_2(aq) \rightarrow Br_2(l) + O_2(g)$$

    b. Permanganate ion can oxidize cyanide ion in acidic solution by the reaction below. Write the corresponding balanced reaction that would occur in basic solution. (2 points)

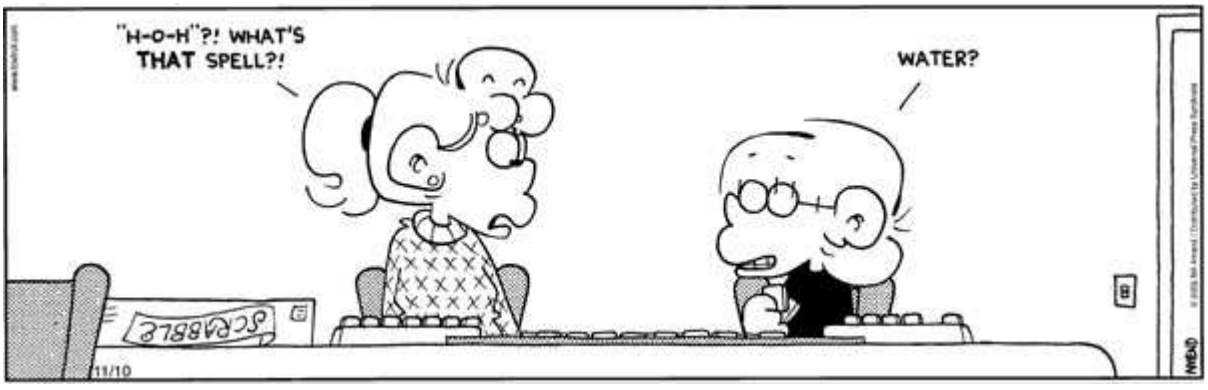
$$2\ MnO_4^- + 3\ CN^- + 2\ H^+ \rightarrow 2\ MnO_2 + 3\ OCN^- + H_2O$$

Possibly Useful Information

$R = 0.08206\ L\ atm\ mol^{-1}\ K^{-1}$	$K = {}^{o}C + 273.15$
1 atmosphere = 760 Torr = 760 mm Hg	Look both ways before crossing the street!
$P_{total}V = n_{total}RT$	$P_A = X_a P_{total}$
$N_a = 6.02214 \times 10^{23}\ mol^{-1}$	$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$
$\%\ by\ mass = \frac{g\ component}{100\ g\ sample}$	$d = m/v$

Vapor Pressure of Water at Various Temperatures

Temperature (°C)	Vapor Pressure (mmHg)
15.0	12.79
17.0	14.53
19.0	16.48
21.0	18.65
23.0	21.07
25.0	23.76
30.0	31.82
50.0	92.51



To save some calculation time, you may round all atomic masses to two (2) decimal points.

1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H 1.00794	2 2A																2 He 4.00260
3 Li 6.941	4 Be 9.01218											5 B 10.811	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.1797
11 Na 22.9898	12 Mg 24.3050	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 Al 26.9815	14 Si 28.0855	15 P 30.9738	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.9961	25 Mn 54.9381	26 Fe 55.847	27 Co 58.9332	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.9216	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.224	41 Nb 92.9064	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.906	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.757	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 *La 138.906	72 Hf 178.49	73 Ta 180.948	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.025	89 †Ac 227.028	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*Lanthanide series	58 Ce 140.115	59 Pr 140.908	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.965	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967
†Actinide series	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237.048	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 (262)