Chem 150 – Exam 2a *Name:* _____
Spring 2008

Chemistry 150 Exam 2

Be sure to put your name on each page. This page can be removed from your exam so that you will have a Periodic Table handy throughout the exam, it does not need to be turned in. Show all your work for non-multiple choice problems which require any sort of calculation, no credit will be given for answers without work shown. If you have shown a significant amount of work or multiple drawings for a problem, draw a box around what you consider your final answer.

Avogadro's Number = 6.022×10^{23} $^{\text{units}}/_{\text{mol}}$
$32.00^{o}F = 0.000^{o}C = 273.15K$
1 foot = 12 inches
1 inch = 2.54cm (exactly)
1 pound = 453.6 g = 16 ounces
1 amu = 1.6605×10^{-24} g
Masses of subatomic particles:
Proton 1.00728amu = 1.6726×10^{-24} g
Neutron 1.00866amu = 1.6749×10^{-24} g
Electron 0.000549amu = 9.1094×10^{-28} g
Density of Water = $1.000^{g}/_{mL}$
$R = 0.08206$ $^{L \cdot atm}/_{mol \cdot K}$
PV=nRT

1 **H** 1.0079																	2 **He** 4.0026
3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.88	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.69	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.03	89 **Ac** 227.03	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 (269)	111 (272)	112 (277)		114		116		

58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.94	70 **Yb** 173.04	71 **Lu** 174.97
90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** 237.05	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (258)	101 **Md** (258)	102 **No** (259)	103 **Lr** (260)

Score

Multiple Choice: Circle the letter of the most correct response. (6pts. per question)

1. Which of the following would you expect to be insoluble in water?
   a. $Ca(NO_3)_2$
   b. $BaSO_4$
   c. $Hg(C_2H_3O_2)_2$
   d. Na_3PO_4
   e. $(NH_4)_2CO_3$

2. Under which of the following conditions is a gas most likely to ***not*** be "ideal"?
   a. Room temperature, 25ºC
   b. High temperature, high pressure
   c. High volume, low pressure
   d. High pressure, high volume
   e. High pressure, low temperature

3. Consider the following reaction:
   $$a\ KBr(aq) + b\ AgNO_3(aq) \rightarrow c\ AgBr(s) + d\ KNO_3(aq)$$
   For every mol of KBr(aq) that reacts, how many mols of AgBr(s) are formed?
   a. 0.25 mols
   b. 0.5 mols
   c. 1 mol
   d. 2 mols
   e. 3 mols

4. Which of the following is ***not*** a correct gas law relationship?
   a. $PV = nRT$
   b. $n_1T_1 = n_2T_2$
   c. $V_1n_1 = V_2n_2$
   d. $P_1 / T_1 = P_2 / T_2$
   e. $P_1V_1 = P_2V_2$

5. In which of the following formulas does sulfur have the lowest oxidation number?
   a. S (s)
   b. SO_2 (g)
   c. Na_2SO_3 (s)
   d. $(NH_4)_2S$ (aq)
   e. $BaSO_4$

6. Which of the following is a redox reaction?
   a. $NH_4NO_3(aq) + NaC_2H_3O_2(aq) \rightarrow NH_4C_2H_3O_2(aq) + NaNO_3(aq)$
   b. $HCl(aq) + KOH(aq) \rightarrow KCl(aq) + H_2O(l)$
   c. $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$
   d. $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
   e. $H_2CO_3(aq) \rightarrow H_2O(l) + CO_2(g)$

Score

7. Consider the following reaction:

$$2\ Cu^{2+}(aq) + Zn(s) \rightarrow 2\ Cu^{+}(aq) + Zn^{2+}(aq)$$

What is ***oxidized*** in this reaction?

a. $Cu^{2+}(aq)$
b. Zn(s)
c. $Cu^{+}(aq)$
d. $Zn^{2+}(aq)$
e. This is not a redox reaction

Multiple Choice Calculations (12pts each):

8. What is the volume of 1.675mols of ideal gas at 0.787atm pressure and 39.61ºC?

a. 6.92 L
b. 4.28 L
c. 19.5 L
d. 54.6 L
e. 13.6 L

9. A steel tank contains an ideal gas at 31.82ºC and 1.88atm. If the tank is cooled to 3.19ºC, what is the pressure of the gas in the tank?

a. 0.188 atm
b. 1.70 atm
c. 1.88 atm
d. 2.07 atm
e. 18.8 atm

10. How many mols of sodium ions are present in 75.00mL of a 3.181M sodium sulfate solution?

a. 0.4772 mols
b. 0.02121 mols
c. 0.1193 mols
d. 0.2386 mols
e. 42.41 mols

11. You have dissolved 8.216g of calcium chloride in enough water to make 250.00mL of solution. What is the concentration of the resulting solution?

a. 0.01851 M
b. 0.03286 M
c. 0.4351 M
d. 0.02719 M
e. 0.2961 M

Score

Problems: (30pts each)

12. 150.0mL of 1.264M calcium nitrate solution is combined with 125.0mL of 1.328 M sodium carbonate solution.
    a. Write a correctly balanced equation for the reaction that takes place.
    b. How many grams of precipitate will this reaction form?
    c. If you collect 11.272g of solid, what is your percent yield?

Always start with a balanced chemical equation:

$Ca(NO_3)_2(aq) + Na_2CO_3(aq) \rightarrow CaCO_3(s) + 2\ NaNO_3(aq)$

If $Ca(NO_3)_2(aq)$ is the limiting reagent, the yield would be:

$$(0.1500\text{L})\left(\frac{1.264\text{mol Ca(NO}_3)_2\text{(aq)}}{\text{L}}\right)\left(\frac{1\text{mol CaCO}_3}{1\text{mol Ca(NO}_3)_2}\right)\left(\frac{100.086\text{g CaCO}_3}{\text{mol CaCO}_3}\right) = 18.98\text{g CaCO}_3\text{(s)}$$

If $Na_2CO_3(aq)$ is the limiting reagent, the yield would be:

$$(0.1250\text{L})\left(\frac{1.328\text{mol Na}_2\text{CO}_3\text{(aq)}}{\text{L}}\right)\left(\frac{1\text{mol CaCO}_3}{1\text{mol Na}_2\text{CO}_3}\right)\left(\frac{100.086\text{g CaCO}_3}{\text{mol CaCO}_3}\right) = 16.61\text{g CaCO}_3\text{(s)}$$

Since $Na_2CO_3(aq)$ produces less product, it is the limiting reagent. The percent yield is:

$$\left(\frac{11.272\text{g}}{16.61\text{g}}\right)x100\% = 67.85\%\text{ yield}$$

13. You have reacted 23.713g of potassium sulfide solid with 250.0mL of 5.318M HCl(aq). If all of the gas produced by this reaction is collected in a 4.000L vessel, what will the pressure be in that vessel? {Assume that the vessel contains only the gas produced in the reaction.}

Always start with a balanced chemical equation:

$K_2S(s) + 2\ HCl(aq) \rightarrow H_2S(g) + 2\ KCl(aq)$

If $K_2S(s)$ is the limiting reagent, the pressure would be:

$$(23.713\text{g K}_2\text{S(s)})\left(\frac{1\text{mol K}_2\text{S}}{110.262\text{g K}_2\text{S}}\right)\left(\frac{1\text{mol H}_2\text{S}}{1\text{mol K}_2\text{S}}\right)\left(\frac{\left(0.08206\ \frac{\text{L•atm}}{\text{mol•K}}\right)(298.15K)}{4.000\text{L}}\right) = 1.315\text{atm}$$

If HCl(aq) is the limiting reagent, the yield would be:

$$(0.2500\text{L HCl(aq)})\left(\frac{5.318\text{mol HCl}}{\text{L HCl(aq)}}\right)\left(\frac{1\text{mol H}_2\text{S}}{2\text{mol HCl}}\right)\left(\frac{\left(0.08206\ \frac{\text{L•atm}}{\text{mol•K}}\right)(298.15K)}{4.000\text{L}}\right) = 4.066\text{atm}$$

Since $K_2S(s)$ produces less product, it is the limiting reagent. The pressure in the vessel is 1.315atm.

Score