**Test 2, Chemistry 121** **Name:_____**
**Spring 2006**

Instructions: You have 75 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

**I. Solubility** (10 pts): Indicate whether the following compounds are soluble in water.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | $Na_3PO_4$ | Soluble | Insoluble | 6. | AgCl | Soluble | Insoluble |
| 2. | $ZnCl_2$ | Soluble | Insoluble | 7. | $TiNO_3$ | Soluble | Insoluble |
| 3. | $FeCrO_4$ | Soluble | Insoluble | 8. | $(NH_4)_2CO_3$ | Soluble | Insoluble |
| 4. | $Ca(OH)_2$ | Soluble | Insoluble | 9. | $AlPO_4$ | Soluble | Insoluble |
| 5. | $PbSO_4$ | Soluble | Insoluble | 10. | $MgSO_4$ | Soluble | Insoluble |

**II. Writing and Balancing Equations**

1. (15 pts) Write the balanced molecular, total ionic and net ionic equations for the reaction of lead (II) nitrate with potassium bromide. (make sure you identify the solid precipitate)

Molecular: _____

Total Ionic: _____

Net Ionic: _____

2. (5 pts) Write the balanced molecular equation for the reaction of sodium hydroxide with hydroiodic acid (HI).

3. (20 pts) Balance the following equations:

   a. $CaO + HCl \rightarrow CaCl_2 + H_2O$

   b. $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

   c. $AlCl_3 + NaOH \rightarrow Al(OH)_3 + NaCl$

   d. $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

**III. Calculations** – show all work for partial credit

1. (15 pts) Sodium thiosulfate pentahydrate, $Na_2S_2O_3 \cdot 5H_2O$ is used in photography development.
   a. Calculate its molar mass. (show all work)

   b. A solution of $Na_2S_2O_3 \cdot 5H_2O$ has a concentration 0.500 M. How many grams of $Na_2S_2O_3 \cdot 5H_2O$ are in 15.0 mL of the solution? (Use the MM from part a)

2. (10 pts) Propylene glycol ($CH_3CHOHCH_2OH$ ) is used as a safe alternative to ethylene glycol, the main ingredient in antifreeze. How many molecules of propylene glycol are in 5.0 mg of $CH_3CHOHCH_2OH$? (MM of $CH_3CHOHCH_2OH$ = 76.09 g/mol)

3. (15 pts) Silicone bracelets have become extremely popular in the last two years. The basic molecular unit of these bracelets is dimethylsiloxane $(CH_3)_2Si(OH)_2$. This is made by reacting dimethyl dichlorosilane, $(CH_3)_2SiCl_2$, with water. How many grams of $(CH_3)_2Si(OH)_2$ are prepared by the reaction of 10.0g of $(CH_3)_2SiCl_2$ with 5.00g of water? (MM of $(CH_3)_2SiCl_2$ = 129.06 g/mol, MM of $H_2O$ = 18.02 g/mol, MM of $(CH_3)_2Si(OH)_2$ = 92.17 g/mol)

$$(CH_3)_2SiCl_2 \quad + \quad 2\ H_2O \rightarrow \quad (CH_3)_2Si(OH)_2 \quad + \quad 2\ HCl$$

4. (10 pts) What volume (in mL) of 0.955 M HCl is required to exactly neutralize 15.0 mL of 0.596 M $Ca(OH)_2$?

$$2\ HCl \quad + \quad Ca(OH)_2 \quad \rightarrow \quad CaCl_2 \quad + \quad H_2O$$

5. (10 pts) Determine the empirical formula of a compound that contains 53.5 % Xe and 46.5 % F.

| | 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** 24.31 | IIIB | IVB | VB | VIB | VIIB | VIIIB | | | 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** 47.90 | 23 **V** 50.94 | 24 **Cr** 52.00 | 25 **Mn** 54.94 | 26 **Fe** 55.85 | 27 **Co** 58.93 | 28 **Ni** 58.71 | 29 **Cu** 63.55 | 30 **Zn** 65.37 | 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** 112.40 | 49 **In** 114.8 | 50 **Sn** 118.7 | 51 **Sb** 121.8 | 52 **Te** 127.60 | 53 **I** 126.90 | 54 **Xe** 131.30 |
| 6 | 55 **Cs** 132.9 | 56 **Ba** 137.3 | 71 **Lu** 175 | 72 **Hf** 178.5 | 73 **Ta** 181 | 74 **W** 183.9 | 75 **Re** 186.2 | 76 **Os** 190.2 | 77 **Ir** 192.2 | 78 **Pt** 195.1 | 79 **Au** 197 | 80 **Hg** 200.59 | 81 **Tl** 204.4 | 82 **Pb** 207.2 | 83 **Bi** 209 | 84 **Po** [209] | 85 **At** [210] | 86 **Rn** [222] |
| 7 | 87 **Fr** [223] | 88 **Ra** [226] | 103 **Lr** [262] | 104 [261] | 105 [262] | 106 [263] | | | | | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 57 **La** 138.9 | 58 **Ce** 140.1 | 59 **Pr** 140.9 | 60 **Nd** 144.2 | 61 **Pm** [145] | 62 **Sm** 150.4 | 63 **Eu** 152 | 64 **Gd** 157.3 | 65 **Tb** 158.9 | 66 **Dy** 162.5 | 67 **Ho** 164.93 | 68 **Er** 167.3 | 69 **Tm** 168.9 | 70 **Yb** 173 |
| 89 **Ac** [227] | 90 **Th** 232 | 91 **Pa** [231] | 92 **U** 238 | 93 **Np** [237] | 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] |