Time: 90 min.   <u>**Chem. 205**</u>   **May 31, 2001**
                            <u>**Final Examination**</u>   **S. Sadek-Hajj**

Family Name :_____   First Name :_____

I.D. #   :_____   Major   :_____

Section (day) :_____   Instructor :_____

SCORE:

I   :_____ 15%

II   :_____ 35 %

III   :_____ 20%

IV   :_____ 21%

V   :_____ 9%

GRADE   :_____ / 100

Useful constants

$$K_w = 1.0 \times 10^{-14}$$

I. (15%) *Circle **T** for True statements and **F** for False ones:*

T   F   Random errors are indeterminate errors that can not be corrected for.

T   F   In using the Mettler balance, the last reading should be taken on the semi-released position.

T   F   Small random errors occur more frequently than large ones.

T   F   Errors that affect the measurements in the same manner are called systematic errors.

T   F   If the molar solubility of calcium phosphate is given by s, then its solubility product is given by $108s^5$

T   F   Among the cations studied in Chemistry 205, those which have +3 charge belong to Group III

T   F   If two sparingly soluble salts have the same value for Ksp then certainly they have the same solubility

T   F   According to Beer's Law the absorbance of a certain species at a given wavelength is inversely proportional to its molar concentration.

T   F   In the Laboratory, if a chemical is spilled on your hand you should immediately dry it with a towel and continue the experiment.

T   F   In qualitative analysis, the reagent that, when added, precipitates the cations present is called the group reagent.

II. (35%) *Circle the letter preceding the best answer:*

- Which of the following statement(s) is(are) reasonable concerning Ksp of a slightly soluble salt:
  a. Ksp is the same as molar solubility and it depends on temperature
  b. Ksp is the same in a solution containing a common ion as in pure water
  c. To calculate Ksp, use solubility in g/l
  d. All of the above
  e. None of the above

- Calculate the molar solubility of $PbCrO_4$ knowing that its $Ksp = 2.0 \times 10^{-14}$
  a. 1.0×10^{-7} M
  b. 3.8×10^{-4} M
  c. 2.0×10^{-14} M
  d. 1.4×10^{-7} M
  e. 4.0×10^{-10} M

- Ammonia is a weak base ($K_b = 1.8 \times 10^{-5}$). Determine the pH of a 0.100M NH_3 solution
  a. 11.13
  b. 2.87
  c. 8.27
  d. 12.09
  e. None of the above

- 25.00ml of HCl 0.100M were added to a beaker containing 25.00 ml of NaOH 0.200M. The pH of the resulting solution is equal to:
  a. 1.30
  b. 13.00
  c. 12.70
  d. 13.30
  e. 2.00

- After balancing the following reaction, the stoichiometric coefficients will be respectively:
  $$Cr_2O_7^{2-} + I^- + H^+ \longrightarrow Cr^{3+} + I_3^- + H_2O$$
  a. 1, 6, 12, 2, 2, 6
  b. 1, 9, 14, 2, 3, 7
  c. 2, 9, 14, 4, 3, 7
  d. 2, 6, 12, 4, 2, 6
  e. Can not be balanced

- The molar solubility of $Pb(IO_3)_2$ in 0.10M $NaIO_3$ solution is 2.4 x 10^{-11}M. Then the Ksp for $Pb(IO_3)_2$ is equal to:
    a. 2.4 x 10^{-13}
    b. 2.4 x 10^{-12}
    c. 5.5 x 10^{-32}
    d. 9.6 x 10^{-13}
    e. 2.4 x 10^{-11}

- An unknown monoprotic acid was titrated with sodium hydroxide. If 0.1592g of the acid needed 11.40ml of 6.839 x 10^{-2}M NaOH to reach the equivalence point, then the molecular weight of the acid is equal to:
    a. 134.0 g/mole
    b. 68.39 g/mole
    c. 124.8 g/mole
    d. 204.2 g/mole
    e. 95.56 g/mole

- 0.5316g of impure sodium oxalate (Mwt = 134.0) sample was treated with permanganate solution 2.924 x 10^{-2}M. The volume of the latter solution needed to completely react with the oxalate was equal to 43.31ml. The percent of pure sodium oxalate in the sample is equal to:
    a. 31.66%
    b. 42.42%
    c. 23.63%
    d. 13.90%
    e. 79.80%

- Which of the following is incorrect:
    a. Zinc, Nickel, and lead ions have charges of +2
    b. Aluminum hydroxide is amphoteric while ferric hydroxide is not
    c. Silver and Nickel from complexes with ammonia
    d. Lead is able to form amphoteric hydroxide and amine complex
    e. (c) and (d)

- What is true aqua regia:
    a. A mixture of concentrated acids
    b. Used to dissolve HgS
    c. It is formed of HCl and HNO_3
    d. (a) and (c)
    e. All of the above

III. A(10%)

An unknown solid sample is suspected to be <u>one</u> out of the following salts:
CaCO$_3$, NaCl, PbCl$_2$, MgCl$_2$ or K$_2$CrO$_4$
Suggest a suitable procedure to guess what salt it is.

B(10%)
Give two ions or compounds that can form:
- precipitate with Cl$^-$ _____   _____

- precipitate with SO$_4^{2-}$ _____   _____

- solution with excess OH$^-$ _____   _____

- complex with NH$_3$ _____   _____

- colored flame upon burning   _____   _____

IV. (21%) An unlabeled bottle is known to contain one of the following solutions. Describe a way to know what solution is in the bottle and write chemical equations where applicable.

    a. $AgNO_3$ or $Pb(NO_3)_2$

    b. $CaCl_2$ or $CuCl_2$

    c. $Al(NO_3)_3$ or $Cu(NO_3)_2$

    d. $Hg(NO_3)_2$ or $Hg_2(NO_3)_2$

    e. $NaCl$ or $NaNO_3$

    f. $MgCl_2$ or $FeCl_3$

    g. $Bi(NO_3)_3$ or $Fe(NO_3)_3$

V. (9%) *Draw a flow chart that describes the procedure of the separation of the following cations if present in a mixture*

$$Hg^{2+}, \ Al^{3+}, \ Hg_2^{2+}, \ Cu^{2+}$$