

Time: 90 min.

Chemistry 205  
Final Exam

June 10, 1998

H. Deeb

Family Name: \_\_\_\_\_

First Name: \_\_\_\_\_

Student No: \_\_\_\_\_

Section: \_\_\_\_\_

Major: \_\_\_\_\_

Grading:

I / 43

II / 18

III / 36

IV / 24

V / 27

VI / 27

Total / 175

**I) Circle the letter that precedes the correct answer in each of the following. There is only one correct answer.**

**\* Which of the following statements is incorrect?**

- a- A constant absolute uncertainty lead to a smaller relative uncertainty as the magnitude of the measurement increases.
- b- Indeterminate error arises from natural limitation on our ability to make physical measurement.
- c- As the reproducibility of the results of an experiment improves, the results tend to be more accurate.
- d- Unlike indeterminate error, determinate error can be discussed and corrected.

**\* Which of the following statements is correct?**

- a- Potassium hydrogen phthalate is an acid and therefore cannot react with other acids.
- b- Potassium hydrogen phthalate can react with both acids and bases.
- c- HCl is a better primary standard than potassium hydrogen phthalate, but it was not used because it is corrosive.
- d- none of the above statement is correct.

**\* The weight of  $\text{H}_3\text{PO}_4$  necessary to prepare 145 ml of 0.8000N  $\text{H}_3\text{PO}_4$  solution is:**

- a-  $3.55 \times 10^{-3}$  g
- b- 11.4 g
- c- 0.116 g
- d- 3.79 g

**\* If compounds AB and  $\text{A}_2\text{C}$  each have solubility products equal to  $4 \times 10^{-18}$ , then it can be concluded that:**

- a- The solubility of AB is the same as that of  $\text{A}_2\text{C}$
- b- The solubility of  $\text{A}_2\text{C}$  is greater than that of AB
- c- The solubility of AB is greater than that of  $\text{A}_2\text{C}$
- d- Solubility of AB and  $\text{A}_2\text{C}$  cannot be compared based on the above data.

**\* Concentrated  $\text{NH}_3$  can be used to dissolve:**

- a- AgI
- b-  $\text{Hg}_2\text{Cl}_2$
- c-  $\text{PbCl}_2$
- d-  $\text{CaCO}_3$

\* **6M HNO<sub>3</sub> can be used to free out the cations in:**

- a- PbSO<sub>4</sub>
- b- HgS
- c- Bi<sub>2</sub>S<sub>3</sub>
- d- AgCl

\* **Which of the following ions cannot be tested by precipitation method?**

- a- Ca<sup>++</sup>, K<sup>+</sup>
- b- Al<sup>+++</sup>, Cu<sup>++</sup>
- c- Ag<sup>++</sup>, Bi<sup>+3</sup>
- d- Na<sup>+</sup>, NH<sub>4</sub><sup>+</sup>

\* **A 2.54 g sample of NaOH was dissolved in 25.0 ml solution and titrated against 0.150 M HCL to the end point. The [Cl<sup>-</sup>] at the stoichiometric point is:**

- a- 0.0263 mole/L
- b- 0.142 mole/L
- c- 2.54 moles/L
- d- 0.150 mole/L

**II) Write the corresponding formula of the missing labelled reagents or products in each of the following sequences.**

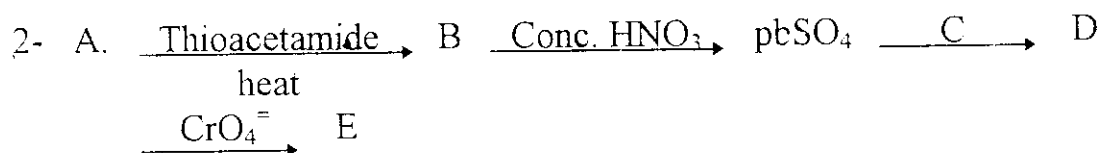
1- Cu(NO<sub>3</sub>)<sub>2</sub> 6M NH<sub>3</sub> → A 6M NH<sub>3</sub> → B C → D reddish brown ppt.

A is: \_\_\_\_\_

B is: \_\_\_\_\_

C is: \_\_\_\_\_

D is: \_\_\_\_\_



A is: \_\_\_\_\_

B is: \_\_\_\_\_

C is: \_\_\_\_\_

D is: \_\_\_\_\_

E is: \_\_\_\_\_

III) How can you distinguish by simple one step visual chemical means (other than the physical color) among each of the following. Write the corresponding chemical equation(s) if applicable and the observations.

a-  $\text{Ag}_2\text{CO}_3$  and  $\text{AgCl}$

b-  $\text{Fe}(\text{OH})_3$  and  $\text{Al}(\text{OH})_3$

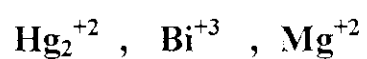
c-  $\text{Fe}(\text{NO}_3)_3$  and  $\text{NH}_4\text{NO}_3$

d-  $(\text{NH}_4)_2\text{C}_2\text{O}_4$  and  $\text{NH}_4\text{Cl}$

e-  $\text{Ca}(\text{NO}_3)_2$  and  $\text{KNO}_3$

f-  $\text{Mg}(\text{OH})_2$  and  $\text{KOH}$

IV) a- Draw a flow chart that summarizes the experimental procedure for the separation of a mixture of the following ions:



b- Write complete balanced equations involved in the confirmatory tests of each ion with the observations.

V) Solve each of the following. Show clearly your calculations to the proper no. of significant figure.

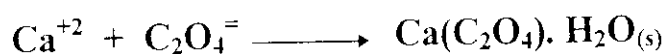
a- What weight of  $\text{Ag}_3\text{AsO}_4$  ( mol. net = 463 g/mole ),  $K_{sp} = 1.0 \times 10^{-22}$ , will dissolve in 250 ml of  $\text{H}_2\text{O}$ .

b- Calculate the solubility of  $\text{BaSO}_4$  in 0.0125 M  $\text{BaCl}_2$  solution.  $K_{sp}$  of  $\text{BaSO}_4 = 1.0 \times 10^{-10}$ .

- c- What is the maximum concentration of  $\text{Ag}^+$  ion in mg/ml that you can have in 0.002 M solution of  $\text{Na}_3\text{PO}_4$ , without the formation of a precipitate of  $\text{Ag}_3\text{PO}_4$  ?  $K_{sp}$  of  $\text{Ag}_3\text{PO}_4 = 1.8 \times 10^{-18}$  .

VI) The calcium content of Urine can be determined by the following procedure:

- 1-  $\text{Ca}^{+2}$  is precipitated as calcium oxalate in basic solution.



- 2- After precipitate is washed to remove any free oxalate, the solid is dissolved in acid.

- 3- The dissolved oxalic acid is heated to  $60^\circ\text{C}$  and titrated with standardized potassium permanganate to the end point according to the following unbalanced equation.



- a- Balance the above equation.



b- Mention one reason to explain why  $\text{KMnO}_4$  cannot be used as a primary standard.

What primary standard can be used to standardize  $\text{KMnO}_4$ .

c- What indicator can be used to detect the end point of the titration involved in step 3 ? What is the change in color observed at the end point ?

d- Suppose that the calcium in 5.00 mls of urine sample is precipitated with excess oxalate, and the excess oxalate is washed away. After the precipitate was dissolved in acid, it required 16.17 mls of standardized  $8.795 \times 10^{-4} \text{ M}$   $\text{KMnO}_4$  solution to titrate the oxalate. Find the molar concentration of  $\text{Ca}^{+2}$  in the urine.