Time:80'

Chem.205

Final Exam

Jan 24,1996

H.Deeb

Family name:_____

First name :_____

Student number:_____

Section (day):_____

Major:_____

Grading:

I	/49
II	/36
III	/30
IV	/42
V	/18
Total	/175

I) Circle the letter that precedes the correct answer.
There is only one correct answer (no double penalty)

* The weight data (grams) of successive 10.00 mls portions of a liquid using a Mettler balance is as follows:
0.9512 , 0.9520 , 0.9532 , 0.9498 , 0.9524
a- The above set of measurement is accurate
b- The above set of measurement is precise
c- The above set of measurement is not precise
d- The absolute uncertainty of each of the above values is 0.0001g, if the weighing is done by difference.

* In the titration of 24.5 ml of potassium hydroxide solution of unknown concentration ,35.7ml of 0.0550 M H_2SO_4 were required to neutralize the KOH solution in reactions where both hydrogen ions of the sulfuric acid react.The normality of KOH solution is:
a- 0.0801 N
b- 0.160 N
c- 0.160×10^{-3} N
d- 0.0377 N

* The solubility product constant for $BaCrO_4$ is 2.00×10^{-10} at 20°C,the molarity of a saturated solution of $BaCrO_4$ at 20°C is:
a- 3.57×10^{-3} M
b- 1.41×10^{-10} M
c- 0.171×10^{-2} M
d- 1.41×10^{-5} M

* The solubilty of Hg_2Cl_2 ($Ksp=1.20 \times 10^{-18}$) in a solution of 0.030 M NaCl is:
a- 1.3×10^{-15} M
b- 1.3×10^{-15} g/l
c- 6.7×10^{-7} M
d- 0.060 M

* The concentration of barium ions in a solution at equilibrium when 7.50 ml of 0.400 M K_2CrO_4 is added to 12.5 ml of 0.200 M $BaCl_2$ (Ksp of $BaCrO_4$ = 1.4 x 10^{-10}) is:

a- 2.8 x 10^{-10} M

b- 5.6 x 10^{-9} M

c- 0.200 M

d- 0.125 M

* Pb^{+2} and Hg_2^{+2} can react with I^- ions to form respectively pbI_2 (Ksp=7.9 x 10^{-9}) and Hg_2I_2 (Ksp=1.1 x 10^{-28}).For a mixture of equal concentrations of pb^{+2} and Hg_2^{+2},

a- The concentration of I^- needed to precipitate pbI_2 is more than that needed to precipitate Hg_2I_2

b- The concentration of I^- needed to precipitate pbI_2 is less than that needed to precipitate Hg_2I_2

c- Pb^{+2} will precipitate faster than Hg_2^{+2} when I^- is added

d- I^- can not be used to separate pb^{+2} and Hg_2^{+2} by fractional precipitation, even if the initial concentrations of pb^{+2} and Hg_2^{+2} are varied

* AgCl and $pbCl_2$ are white salts,

a- $pbCl_2$ is more soluble than AgCl in aqueous solution

b- 1M K_2CrO_4 will dissolve AgCl, but not $pbCl_2$.

c- They both dissolve in 6M HNO_3.

d- They both dissolve in 6M HCl.

II) What is the reagent needed to separate each of the following pairs of ions when present in aqueous solution, include observations.

- pb^{+2} and Cu^{+2}

- Ag^{+} and Hg^{+2}

- Fe^{+3} and Ca^{+2}

- Mg^{+2} and K^{+}

- Ca^{+2} and Na^{+}

- NH_4^{+} and Al^{+3}

III) Write balanced chemical equations,representing each of the following reactions.

- A reaction done in one of the experiments, in which $KMnO_4$ served as its own indicator

- Confirmatory test of Cu^{+2} with the observation

- confirmatory test of Hg_2^{+2} with the observation

- Al^{+3} when heated with thioacetamide

- Amphoteric properties of $pb(OH)_2$

IV) Answer each of the following questions breifly and clearly.

- Why NH_3/NH_4^+ buffered solution is used to precipitate Al^{+3} and Fe^{+3} instead of conc. NaoH

- What is the disadvantage of using 6M HCl instead of 6M HNO_3 to dissolve group II sulfides.

- How can you distinguish between the two white solids $(NH_4)_2\ C_2O_4$ and NH_4Cl by simple visual means using a metal cation.

- One of the limitations for applying Bear's Law is to use λmax which can be determined experimentally.
  Explain why λ max. and not any other λ at which absorption takes place.
  Mention one other limitation for Bear's Law.

- Explain briefly using chemical equation/s why 6M HCL will precipitate Ag^+, but fuming HCl will not.

- Account for the following:
  Addition of dilute HCl to a saturated solution of AgCl will decrease the solubility of AgCl, while when added to a saturated solution of $ZnCO_3$,the solubility of $ZnCO_3$ is increased.

- Addition of basic NH_3 to a saturated solution of AgCl will reasonably increase the solubility of AgCl,while addition of basic Sodium Carbonate does not have any appreciable effect on solubility of AgCl.

V) Solve the following problem, show your solution and report the answer to the proper number of significant figures. Be clear, uncomprehensible or vague calculations will not be considered.

* CO^{+2} can be analyzed by treatment with a known excess of thiocyanate in the presence of pyridine:

$$CO^{+2} + 4\ C_5H_5N + 2SCN^- \longrightarrow CO(C_5H_5N)_4(SCN)_2(s)$$

The precipitate is filtered off, and the SCN^- content of the filtrate is determined by Volhard titration. A 25.00 ml unknown solution was treated with 3 ml of pyridine and 25.00 ml of 0.1028M KSCN in a 250-ml volumetric flask. The solution was diluted to the mark, mixed, and filtered. After the first few milliliters of filtrate were discarded, 50.0 ml of filtrate was acidified with HNO_3 and treated with 5.00 ml of 0.1055 M $AgNO_3$. After addition of Fe^{+3} indicater, the excess Ag^+ required 3.76 ml of 0.1028 M KSCN to reach the Volhard end point. Calculate the CO^{+2} concentration in the unknown.