: 1 hr. 30 min. | Chem. 205 Final Exam | Jan. 20, 2000 S. Sadek

Family Name: _____ First Name: _____

I.D. #: _____ Section: _____

Instructor: _____

Score:

I. _____ / 30

II. _____ / 36

III. _____ / 19

IV. _____ / 15

Grade: _____ / 100

☺ *GOOD LUCK*

I) A (12%) Circle (T) for true statements and (F) for false ones:

T F To prepare a primary standard solution, one can use a beaker provided that he can close its top tightly with parafilm paper.

T F The equivalent weight of Al when it reacts with hydrochloric acid, to produce $AlCl_3$ and H_2, is equal to its molecular weight divided by 6.

T F In the qualitative analysis of Groups II ions, sulfuric acid can be used to adjust the pH instead of hydrochloric acid.

T F After performing the following operation

$$\frac{(5.32x11.030)+109.3}{8.4+202.6}$$

The answer should be rounded to 4 significant figures.

T F In the identification of aluminum, the dye should be added before ammonia because the dye adsorbs to the hydroxide while it is forming.

T F Copper II and iron III can be separated by addition of excess base.

T F Potassium thiocyanate was used in the Volhard analysis for chloride and in the qualitative analysis of Group III ions.

T F A cation that forms a precipitate with chromate, sulfate and chloride is lead.

B (6%) Fill in the blanks:

A balance which gives the weight of a Known 10.000 g standard as 10.001 g is more _____ than one which gives the weight of the same standard as 10.008 g.

Systematic errors reduce _____ by systematically offsetting the observed data.

The subjectivity of the operator who takes the reading from some uniformly graduated scale can lead to a _____ error.

_____ errors result from insufficiently controlled variations in measurement conditions.

In a set of data, the degree of scatter is related to _____ of the measurements.

A set of measurements is said to be _____ if the relative average deviation from the mean is less than 2ppt.

C (12%) Define in writing one sentence:

Solubility:

Primary standard:

Hygroscopy substance:

Amphoteric substance:

Flame test:

Group reagent:

II (36%) Circle the letter preceding the best answer:

The oxidizing agent and the reducing agent in the following reaction, are respectively:

$$Bi\,(s) + 4\,HNO_3\,(aq) \rightarrow Bi(NO_3)_3\,(aq) + NO\,(g) + 2H_2O\,(l)$$

a- HNO_3 and $Bi(NO_3)_3$
b- HNO_3 and Bi
c- Bi and HNO_3
d- Bi and NO
e- This is not a redox reaction.

50.00 ml Na_2SO_4 0.0152 M were mixed with 50.00 ml $Ca(NO_3)_2$ 0.0125M. Knowing that Ksp($CaSO_4$) = 9.1 x 10^{-6}, and ionic product of XY is $[X]_0[Y]_0$.

a- a precipitate will form
b- no precipitate will form
c- the ionic product is greater than Ksp.
d- The ionic product is less than Ksp.
e- (a) and (c)
f- (b) and (c)

The molar solubility of $Ca_3(PO_4)_2$ whose Ksp=1.2 x 10^{-26} is given qualitatively by:

a- $(Ksp/108)^{1/5}$
b- $(Ksp/6)^{1/5}$
c- $(Ksp)^{1/5}$
d- $(Ksp/108)^{1/2}$
e- None of the above, my answer is _____ .

Ammonia is a complexing agent and a source of hydroxide ion:

a- It forms a solid with Al^{3+}
b- It forms a complex with Ag^{+}
c- It forms a solution with K^{+}
d- It forms a solid with Fe^{3+}
e- (a) , (b) and (d)
f- All of the above are true statements.

Potassium and sodium ions can be identified by the flame test, by giving respectively:

a- violet and red flames
b- red and violet flames
c- yellow and red flames
d- violet and yellow flames
e- yellow and violet flames

The confirmatory reagents for magnesium and copper are respectively

a- K_2CrO_4 and $K_4Fe(CN)_6$
b- Na_2HPO_4 and $K_4Fe(CN)_6$
c- K_2CrO_4 and KSCN
d- Na_2HPO_4 and KSCN
e- None of the above.

Precipitation method is not a good way of separating

a- Al^{3+} and Fe^{3+}
b- K^+ and Ag^+
c- Na^+ and NH_4^+
d- K^+ and Ca^{2+}
e- None of the above.

A 5.00 ml aliquot of a standard iron (III) solution 8.393×10^{-4} M, was treated with a complexing agent X to form the iron(II)-X complex, and finally diluted to exactly 100.0 ml. The absorbance of the resulting solution was measured in 1-cm spectrophotometer cell and found to be 0.467 at 510 nm. The percent transmittance of the solution was:

a- 34.1 %
b- 46.7 %
c- 33.0 %
d- 53.3 %
e- 17.3 %

The molar concentration (in M) and the molar absorpitivity (in $M^{-1}cm^{-1}$) of the iron(II) – X complex, in the previous question, were respectively:

a- 4.20×10^{-3} and 1.96×10^{3}
b- 8.39×10^{-4} and 5.57×10^{2}
c- 8.39×10^{-6} and 5.57×10^{4}
d- 5.00×10^{-2} and 9.34×10^{2}
e- 4.20×10^{-5} and 1.11×10^{4}

III (12%)

A Chemistry 205 student was given five bottles containing five different metal nitrate solutions. To label the bottles, he tested each solution in the left column separately with a few drops of the reagents listed horizontally, and he recorded his observations.

	Sulfuric acid	Sodium chloride	Ammonia
Solution (1)	precipitate	--	--
Solution (2)	precipitate	precipitate	precipitate
Solution (3)	--	precipitate	complex
Solution (4)	--	--	complex
Solution (5)	--	precipitate	precipitate

After careful study of the above table:

a- Label the bottles;
Bottle (1) contains

Bottle (2) contains

Bottle (3) contains

Bottle (4) contains

Bottle (5) contains

b- Write the formulas of the precipitates and of the complexes in the space provided in the above table.

IV (16%)

In one of the sessions of Chemistry 205, the instructor provided the students with a solution containing the cations listed below. Making use of precipitation, complex-forming and amphoteric characteristics, the brave students developed a simple procedure and separated the cations. Draw a flow chart that shows the steps followed in the separation. (Hint: The students used NaOH, NH_3 and HCl only; However, you may choose other reagents).

Sn^{2+} Fe^{3+} Zn^{2+} Cu^{2+} Ag^{+}

V (16%) Draw a flow sheet that describes how you can separate and identify the following ions when present in a mixture:

Ag^{+} , Pb^{2+} , Hg^{2+} , Cu^{2+} , Al^{3+} , Ca^{2+} , and Na^{+}