Time: 80 min.

Chemistry 205
Final Examination

Jan. 25, 1999
S. Sadek

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Family Name: _____

First Name: _____

Student Number: _____ Section: _____

Lab. Instructor: _____

Question	I	_____	out of 25
	II	_____	out of 35
	III	_____	out of 12
	IV	_____	out of 12
	V	_____	out of 16
Total		_____	out of 100

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Good luck

I (25%) Circle the letter preceding the best answer:

What weight of Ag_3AsO_4 (M.wt. = 463), Ksp = 1.0×10^{-22}, will dissolve in 250 ml of H_2O?

a- 6.5×10^{-5} g
b- 1.6×10^{-4} g
c- 1.4×10^{-6} g
d- 1.9×10^{-12} g
e- 8.9×10^{-10} g

A 100.0 ml sample of spring water was treated to convert any iron present to Fe^{2+}. Addition of 5.785 ml of 0.002107 M $K_2Cr_2O_7$ resulted in the reaction:

$$6\ Fe^{2+} + Cr_2O_7^{2-} + 14\ H^+ \rightarrow Fe^{3+} + 2\ Cr^{3+} + 7\ H_2O$$

The weight of iron in the sample (in mg):

a- 0.01219
b- 0.6808
c- 70.60
d- 0.07313
e- 4.084

The solubility of $BaSO_4$ (Ksp = 1.0×10^{-10}) in 0.0125 M $BaCl_2$ solution is

a- 8.0×10^{-9} M
b- 1.0×10^{-5} M
c- 8.0×10^{-10} M
d- 1.2×10^{-7} M
e- None of the above, my answer is _____

Each of the following three unknown solutions (A,B, and C) was Known to contain just <u>one</u> group I ion. (A) and (C) gave two different precipitates with HCl that were both insoluble in hot water; The precipitate of (C) was soluble in ammonia while that of (A) was not. (B) gave a precipitate that was soluble in either hot water or in concentrated HCl. The ions present in A, B, and C were respectively:

a- Ag^{+} , Pb^{2+} , Hg^{2+}
b- Ag^{+} , Pb^{2+} , Hg_2^{2+}
c- Hg^{2+} , Pb^{2+}, Ag^{+}
d- Hg_2^{2+}, Pb^{2+}, Ag^{+}
e- Can not be determined from the given information.

List five cations given that the first and the second form amphoteric metal hydroxides, the third and the fourth form amine complexes, and the fifth exhibits both properties.

a- Al^{3+} , Pb^{2+}, Cu^{2+} , Ag^{+} , Zn^{2+}
b- Al^{3+} , Pb^{2+} , Ni^{2+} , Sn^{2+} , Zn^{2+}
c- Sn^{2+} , Al^{3+} , Ni^{2+} , Cu^{2+} , Zn^{2+}
d- Zn^{2+} , Ni^{2+} , Cu^{2+} , Ag^{+} , Sn^{2+}
e- (a) and (c)

<u>II (35%)</u> Answer the following short questions:

Sodium hydroxide absorbs moisture when exposed to the atmosphere. A student placed a pellet of NaOH on a watch glass. A few days later, he noticed that the pellet was covered with a white solid.

a- What do we call this property of NaOH?
b- Is NaOH a good primary standard? Name 3 characteristics of a good primary standard.
c- What is the identity of the solid formed?

III (12%) After development of the $KMnO_4$ color at 525 nm and dilution to 250 ml, the absorbance of a 1.00 g sample of cast iron containing manganese Mn, in a 1.00 cm cell , was 0.484. Using the same cell and at the same wavelength, the absorbance of a solution prepared by dilution of 5.00 ml 0.0185 M $KMnO_4$ to 250 ml was 0.400. Calculate by showing your reasoning the percent Mn with Cast iron.

(Hint $[KMnO_4] = [Mn]$, At. wt. of Mn = 54.94)

A solution of $Ba(OH)_2$ was standardized against 0.1016 g of primary standard-grade benzoic acid C_6H_5COOH (122.12 g/mole).
An end point was observed after addition of 44.42 ml of base.

a- Calculate the molarity of the base.

b- Calculate the uncertainty of the molarity knowing that the acid was weighed on a Mettler balance and the base was delivered from a buret.

Fill in the blanks:

* _____ is a reagent used to identify the presence of ferric ion by the formation of _____.
* The identification of potassium ion is done by the _____, and the color will be _____.
* _____ have different colors in acidic and basic solutions. For example, _____ is blue in base, but it is _____ in an acidic medium.
* In qualitative analysis, the source of sulfide ion was _____.
* In Group III and IV ions analysis, a solid mixture of _____ and _____ is separated by addition of excess base.

When sodium sulfide solution is added to aluminum nitrate solution, and after heating the mixture, a black solid is expected to precipitate. Is this true? Explain by writing the chemical reactions involved.

IV (12%) **A 6.881 g sample containing magnesium chloride and sodium chloride was dissolved in sufficient water to give 500.0 ml of solution. The magnesium in a 50.00 ml aliquot was precipitated as $MgNH_4PO_4$ (M.wt. = 137.29) of which 0.2216 g was collected.**

a- Write balanced equation for the precipitation reaction.

b- Calculate the percentage of sodium chloride in the sample.