9/15 → 15/25

Analytical Chemistry
Second Exam

د. محمود علاوي

Name: .... Date: 12/12/2012

Reg. No.: ....Seat no ....

Section: 1 2 3 4 5 6

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15
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45

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1.	a	b	c	d	e	9.	a	b	c	d	e
2.	a	b	c	d	e	10.	a	b	c	d	e
3.	a	b	c	d	e	11.	a	b	c	d	e
4.	a	b	c	d	e	12.	a	b	c	d	e
5.	a	b	c	d	e	13.	a	b	c	d	e
6.	a	b	c	d	e	14.	a	b	c	d	e
7.	a	b	c	d	e	15.	a	b	c	d	e
8.	a	b	c	d	e						

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GOOD LUCK

1. What volume of 0.200 M HCl must be added to 250.0 mL of 0.300 M sodium mandelate (NaA) to produce a buffer solution with pH of 3.37. K_a of mandelic acid (HA) is: 4.0×10^{-4}

a) 97 mL b) 40 mL c) 0.4 mL d) 1601 mL e) 194 mL

2. Calculate the ionic strength of a solution that is 0.10 M in $FeCl_3$ and 0.20 M in $FeCl_2$.

a) 2.4 M b) 0.8 M c) 1.2 M d) 1.6 M e) 0.5 M

3. Using activities, calculate the solubility of $BaSO_4$ in 0.0333M solution of $Mg(ClO_4)_2$. The thermodynemic solubility product constant for $BaSO_4$ is : 1.1×10^{-10}

a) 1.0×10^{-5} M b) 1.1×10^{-10} M c) 0.10 M d) 2.0×10^{-5} M e) 2.8×10^{-5} M

4. Neglecting any effect caused by volume changes upon addition of sodium hydroxide to a dilute solution of acetic acid, would you expect the ionic strength of the acetic acid solution to:

a) increase
b) decrease
c) remains constant
d) we cannot predict what will happen to the ionic strength
e) none of the above statements is correct.

5. The correct mass- balance equation for an aqueous solution saturated with $Fe(OH)_3$ is:

a) $[Fe^{3+}] = 3[OH^-]$
b) $3[Fe^{3+}] + [H_3O^+] = [OH^-]$
c) $[Fe^{3+}] + [H_3O^+] = [OH^-]$
d) $[Fe^{3+} + [OH]^- = [H_3O^+]$
e) none of the above

6. The molar solubility for $BaSO_4$ is lowest when dissolved in a solution that has $[H_3O^+]$ of :

a) 2.50M
b) 1.50 M
c) 0.10 M
d) 0.20 M
e) 0.06 M

7. Which is the correct charge – balance equation of solution containing 0.2 M H_3AsO_4

a) $3[AsO_4^{3-}] + [H_3O^+] = [OH^-]$
b) $3[AsO_4^{3-}] + [OH^-] = [H_3O^+]$
c) $3[H_2AsO_4^-] + [H_3O^+] = [OH^-]$
d) $[AsO_4^{3-}] + [H_3O^+] = [OH^-]$
e) $3[AsO_4^{3-}] + [H_2AsO_4^-] + 2[HAsO_4^{2-}] + [OH^-] = [H_3O^+]$

(1) $HA + H_2O \rightleftharpoons A^- + H_3O^+$

$NaA + HCl \rightleftharpoons HA + NaCl$

$250\ ml \times 0.3\ M$ ‖ $75\ mmol$; $V \times 0.2\ M$ ‖ $x\ mmol$

$pH = 3.37 \rightarrow [H_3O^+] = 4.265\times10^{-4}$

$[H_3O^+] = Ka \frac{[HA]}{[A^-]}$

$4.265\times10^{-4} = 4\times10^{-4} \times \frac{x}{75 - x}$

$x = 38.7\ mmol$

$V \times 0.2 = 38.7$

$V = 193.5\ ml$

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(2) $FeCl_3$ 0.1 M → Fe^{3+} 0.1 , Cl^- 0.3 M

$FeCl_2$ 0.2 M → Fe^{2+} 0.2 M , $2Cl^-$ 0.4 M

$\mu = \frac{1}{2}(0.1\times3^2 + 0.3\times1^2 + 0.2\times2^2 + 0.4\times1^2)$

$= \frac{1}{2}(2.4) = \boxed{1.2}$

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(3) $K'_{sp} = \frac{K_{sp}}{f_{Ba^{+2}} \cdot f_{SO_4^{2-}}}$

$Mg(ClO_4)_2 \rightarrow Mg^{2+} + 2ClO_4^-$

0.0333   0.0333   0.0666

$\mu = \frac{1}{2}((0.0333\times4) + 0.0666\times1) = 0.099 \approx 0.1$

$K'_{sp} = \frac{1.1\times10^{-10}}{0.31\times0.38} = 8.27\times10^{-10}$

$BaSO_4 + H_2O \rightleftharpoons Ba^{+2} + SO_4^{2-}$

x   x   x

$K'_{sp} = x^2 \rightarrow x = \sqrt{K'_{sp}}$

$= \sqrt{8.27\times10^{-10}} = 2.8\times10^{-5}$

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(4) $HA + NaOH \rightarrow NaA + H_2O$

بعدين سيتفاعل مع HA اكثر ليتبقى

A^- , Na^+ ← بتزيد Ionic strength

8. Calculate the hydrogen ion concentration at which Tl^+ precipitates quantitatively from a solution that is 0.01 M in Tl^+ using saturated solution of H_2S (0.10 M) as a precipitating agent. K_{sp} for $Tl_2S = 6x10^{-22}$.
Use 1×10^{-4} as a criterion for quantitative precipitation.

For H_2S : $K_1 = 9.6 \times 10^{-8}$ and $K_2 = 1.3 \times 10^{-14}$

a) $0.55 x10^{-3}$M b) 1.40×10^{-4}M c) 4.56×10^{-5}M d) 1.08M e) 3.5

9. A precipitate of $BaSO_4$ is contaminated with $Ba(NO_3)_2$. The best way to remove the impurity is:
a) filtration b) ignition c) digestion d) washing e) none of the above

10. The process of dispersing an insoluble material into a liquid as a colloid is called:

a) coagulation b) nucleation c) peptization d) occlusion e) inclusion

11. A sample of a pure metal chloride (MCl) weighing 0.58051 g is dissolved in water and the chloride precipitated as AgCl. If the precipitate weighs 1.4236 g, calculate the atomic weight of the metal (M), assuming that the atomic weights of chlorine and silver are 35.453 and 107.868, respectively.

a) 35.453 b) 45.980 c) 70.906 d) 30.653 e) 22.990

12. In the titration of 50.00 ml of 0.40 M of Na_2SO_4 with 0.20 M $Pb(NO_3)_2$, $PbSO_4$ precipitates down. Calculate the P function of Pb^{2+} (pPb) after adding 50.00 ml of $Pb(NO_3)_2$. K_{sp} for $PbSO_4$ is: 1.6×10^{-8}

a) 6.79 b) 7.11 c) 5.08 d) 3.89 e) 2.72

13. In the titration of 50.00 ml of 0.40 M of Na_2SO_4 with 0.20 M $Pb(NO_3)_2$, $PbSO_4$ precipitates down. Calculate the P function of Pb^{2+} (pPb) after adding 100.00 ml of $Pb(NO_3)_2$. K_{sp} for $PbSO_4$ is: 1.6×10^{-8}

a) -6.80 b) 7.11 c) 5.08 d) 3.89 e) 2.72

14. Chloride ions are to be determined by titration in a solution of pH 1.5. Which method would give the best results:
a) Mohr's method (potassium chromate indicator)
b) Fajan's method (adsorption indicators)
c) Volhard's method(Fe^{3+} indicator)
d) titration with a base using phenolphthalein indicator
e) none of the above.

15. Which of the following anions would give the sharpest end point when titrated with silver ions:

a) bromide ion (K_{sp} for AgBr is 5.0×10^{-13})
b) cyanide ion (K_{sp} fpr AgCN is 2.2×10^{-16})
c) thiocyanate ion (K_{sp} for AgSCN is 1.1×10^{-12})
d) iodate ion (Ksp for $AgIO_3$ is 3.1×10^{-8})
e) all ions (Br^-, CN^-, SCN^-, and IO_3^-) would show the same sharpness of end point when titrated with silver nitrate.

(8) $[S^{2-}] = \frac{6.48 \times 10^{-24}}{[H_3O^+]^2}$

$K_1 \times K_2 = \frac{[H_3O^+][HS^-]}{[H_2S]} \cdot \frac{[H_3O^+][S^{-2}]}{[HS^-]}$

$9.6 \times 10^{-8} \times 1.3 \times 10^{-14} = \frac{[H_3O^+]^2 \cdot [S^{-2}]}{[H_2S]}$

$[S^{-2}]^{0.1} = \frac{1.25 \times 10^{-23}}{[H_3O^+]^2}$ — (1)

$Tl_2S \rightleftharpoons 2Tl^+ + S^{2-}$

$K_{sp} = [Tl]^2 \cdot [S^{2-}]$

$6 \times 10^{-22} = (10^{-4})^2 \times \frac{1.25 \times 10^{-22}}{[H_3O^+]^2}$

$\Rightarrow [H_3O^+] = 4.56 \times 10^{-5}$

(11) $MCl \rightarrow M^+ + Cl^-$

$Cl^- + Ag^+ \rightarrow AgCl_{(s)} \downarrow$

X — 1.4236 g

35.453 g → 107.868 + 35.453 = 143.321 g (نسبة وتناسب)

? → 1.4236 g

→ 0.352 g

$MCl \rightarrow M^+ + Cl^-$

0.5805 — 0.2285 g — 0.352 g

$\frac{0.352 \text{ g}}{35.453}$ = 9.93 mmol

$n_{Cl^-} = n_{M^+} = 9.93$ mmol

$Mw_{(M^+)} = \frac{0.2285 \text{ g}}{9.93 \times 10^{-3} \text{ mol}}$

= 23 g/mol

(12) $Na_2SO_4 + Pb(NO_3)_2 \rightleftharpoons PbSO_4 \downarrow + 2NaNO_3(aq)$

50 ml × 0.4 = 20 mmol; 50 × 0.2 = 10 mmol

(محدد / متبقي ... كلي)

100 mol

||

(0.1 M) → التركيز

$PbSO_4 + H_2O \rightleftharpoons Pb^{+2} + SO_4^{2-}$

$K_{sp} = [Pb^{2+}] \cdot [SO_4^{-2}]$

$[Pb^+] = \frac{1.6 \times 10^{-8}}{0.1} = 1.6 \times 10^{-7}$

$P(Pb) = 6.79$

(13) 20 mmol → at equ. pt.

$K_{sp} = [Pb^{+2}]^2$

$[Pb] = \sqrt{1.6 \times 10^{-8}} = 0.26 \times 10^{-4}$

$P(Pb) = 3.89$

Values of t for Various Levels of Probability

Degrees of Freedom	80%	90%	95%	99%	99.9%
1	3.08	6.31	12.7	63.7	637
2	1.89	2.92	4.30	9.92	31.6
3	1.64	2.35	3.18	5.84	12.9
4	1.53	2.13	2.78	4.60	8.61
5	1.48	2.02	2.57	4.03	6.87
6	1.44	1.94	2.45	3.71	5.96
7	1.42	1.90	2.36	3.50	5.41
8	1.40	1.86	2.31	3.36	5.04
9	1.38	1.83	2.26	3.25	4.78
10	1.37	1.81	2.23	3.17	4.59
15	1.34	1.75	2.13	2.95	4.07
20	1.32	1.73	2.09	2.84	3.85
40	1.30	1.68	2.02	2.70	3.55
60	1.30	1.67	2.00	2.62	3.46
∞	1.28	1.64	1.96	2.58	3.29

ritical Values for the Rejection Quotient, Q*

Number of Observations	Q_{crit} (Reject if $Q > Q_{crit}$) 90% Confidence	95% Confidence	99% Confidence
3	0.941	0.970	0.994
4	0.765	0.829	0.926
5	0.642	0.710	0.821
6	0.560	0.625	0.740
7	0.507	0.568	0.680
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568

Confidence Levels for Various Values of z

Confidence Level, %	z
50	0.67
68	1.00
80	1.28
90	1.64
95	1.96
95.4	2.00
99	2.58
99.7	3.00
99.9	3.29

Activity Coefficients for Ions at 25 °C

Ion	α_X, nm	Activity Coefficient at Indicated Ionic Strength 0.001	0.005	0.01	0.05	0.1
H_3O^+	0.9	0.967	0.934	0.913	0.85	0.83
Li^+, $C_6H_5COO^-$	0.6	0.966	0.930	0.907	0.83	0.80
Na^+, IO_3^-, HSO_3^-, HCO_3^-, $H_2PO_4^-$, $H_2AsO_4^-$, OAc^-	0.4–0.45	0.965	0.927	0.902	0.82	0.77
OH^-, F^-, SCN^-, HS^-, ClO_3^-, ClO_4^-, BrO_3^-, IO_4^-, MnO_4^-	0.35	0.965	0.926	0.900	0.81	0.76
K^+, Cl^-, Br^-, I^-, CN^-, NO_2^-, NO_3^-, $HCOO^-$	0.3	0.965	0.925	0.899	0.81	0.75
Rb^+, Cs^+, Tl^+, Ag^+, NH_4^+	0.25	0.965	0.925	0.897	0.80	0.75
Mg^{2+}, Be^{2+}	0.8	0.872	0.756	0.690	0.52	0.44
Ca^{2+}, Cu^{2+}, Zn^{2+}, Sn^{2+}, Mn^{2+}, Fe^{2+}, Ni^{2+}, Co^{2+}, Phthalate^{2-}	0.6	0.870	0.748	0.676	0.48	0.40
Sr^{2+}, Ba^{2+}, Cd^{2+}, Hg^{2+}, S^{2-}	0.5	0.869	0.743	0.668	0.46	0.38
Pb^{2+}, CO_3^{2-}, SO_3^{2-}, $C_2O_4^{2-}$	0.45	0.868	0.741	0.665	0.45	0.36
Hg_2^{2+}, SO_4^{2-}, $S_2O_3^{2-}$, CrO_4^{2-}, HPO_4^{2-}	0.40	0.867	0.738	0.661	0.44	0.35
Al^{3+}, Fe^{3+}, Cr^{3+}, La^{3+}, Ce^{3+}	0.9	0.737	0.540	0.443	0.24	0.18
PO_4^{3-}, $Fe(CN)_6^{3-}$	0.4	0.726	0.505	0.394	0.16	0.095
Th^{4+}, Zr^{4+}, Ce^{4+}, Sn^{4+}	1.1	0.587	0.348	0.252	0.10	0.063
$Fe(CN)_6^{4-}$	0.5	0.569	0.305	0.200	0.047	0.020

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Analytical Chemistry
Second Exam

Name: ....[redacted]............................ Date: 30/4/2012

Reg. No.: ....0109375........Seat no.:......................

Section: 1 2 3 4 9-10 202

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1.	a	b	c	d	e	9.	a	b	c	d	e
2.	a	b	c	d	e	10.	a	b	c	d	e
3.	a	b	c	d	e	11.	a	b	c	d	e
4.	a	b	c	d	e	12.	a	b	c	d	e
5.	a	b	c	d	e	13.	a	b	c	d	e
6.	a	b	c	d	e	14.	a	b	c	d	e
7.	a	b	c	d	e	15.	a	b	c	d	e
8.	a	b	c	d	e						

GOOD LUCK

1. Calculate the % relative error in solubility calculation of CuCl in 0.05M KNO_3 when using molarities instead of activities. For CuCl $K_{sp} = 8.1\times10^{-19}$

a) -46 % b) +36% c) -18% d) +18% e) -36%

2. A correct mass-balance equation for a solution saturated with CaC_2O_4 is:-

a) $[Ca^{2+}] = [C_2O_4^{2-}] + [HC_2O_4^-] + [H_2C_2O_4]$
b) $2[Ca^{2+}] + [H_3O^+] = 2[C_2O_4^{2-}] + [OH^-]$
c) $[Ca^{2+}] + [H_3O^+] = 2[C_2O_4^{2-}] + [OH^-]$
d) $2[Ca^{2+}] + [H_3O^+] = [C_2O_4^{2-}] + [OH^-]$
e) $[Ca^{2+}] = [C_2O_4^{2-}]$

3. Calculate the molar solubility of $Mg(OH)_2$ ($Ksp = 7.1 \times 10^{-12}$) in water.

a) 7.1×10^{-12} M b) 2.4×10^{-14} M c) 4.1×10^{-11} M d) 1.2×10^{-4} M

e) 8.0×10^{-18} M

4. Generation of hydroxide ion as a precipitating agent from urea for the purpose of precipitating Fe^{3+} as $Fe(OH)_3$ is called:

a) peptization
b) coagulation
c) precipitation from homogeneous solution.
d) digestion of the precipitate
e) coprecipitation

5. An aqueous solution contains $NaNO_3$ and KBr. The bromide ion was separated as AgBr by addition of excess precipitating agent $AgNO_3$. The charge on the surface of the primary adsorption layer of the colloidal precipitate is

a) Positive charge due to the adsorption of potassium ions
b) Negative charge due to the adsorption of nitrate ions
c) Positive charge due to the adsorption of silver ions
d) Negative charge due to the adsorption of bromide ions .
e) Neutral since primary adsorption layer will neutralize the counter ions

6. Which of the following statements is correct:

a) Peptization is heating the precipitate in solution to coagulate the precipitate.
b) Inclusion or mixed crystal formation occurs in case of colloidal precipitates.
c) Coprecipitaion is bringing down with the precipitate substance which are normally soluble.
d) Colloidal precipitates are best washed with distilled water.
e) Occlusion is replacing some ions in the crystal by foreign ions.

7. A sample of pure sodium oxalate, $Na_2C_2O_4$, weighing 0.2856 g (molar mass 134 g/mol) is dissolved in water, sulfuric acid is added, and the solution is titrated at 70 °C, requiring 45.12 mL of a $KMnO_4$ solution. The end point is overrun and back-titration is carried out with 1.78 mL of 0.0516 M solution of oxalic acid. Calculate the molarity of the $KMnO_4$ solution.

Equation is:

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow Mn^{2+} + 10CO_2 + 8H_2O$$

a) 0.048 M   b) 0.0197 M   c) 0.0394M   d) 0.009 M   e) 0.018 M

8. In the titration 50.0 mL 0.1 M NaCl with 0.1 M $AgNO_3$, calculate pCl after addition of 50.0 mL $AgNO_3$

K_{sp} for AgCl = 1×10^{-10},

a) 6.00   b) 5.00   c) 7.5   d) 7.00   e) 9.00

9. Chloride ions are to be determined by titration in a solution of pH 1.5. Which method would give the best results:-

a) Mohr's method using K_2CrO_4 indicator.
b) Fajan's method using dichloroflourescein indicator.
c) Titration with EDTA.
d) Titration with HCl.
e) Back titration using Volhard's method in which Fe^{3+} indicator is used.

10. Iodide ions are to be separated from chloride ions as silver salts in a solution containing 0.10 M of each ion. Given that K_{sp} for AgCl = $1.8x10^{-10}$, K_{sp} for AgI is $7.3x10^{-17}$ and using $1x10^{-5}$ M as a criterion for quantitative precipitation, which of the following statements is correct:-

a) separation is not feasible.
b) I^- can be separated if $[Ag^+]$ is less than $7.3x10^{-12}$ M.
c) I^- can be separated from Cl^- if $[Ag^+]$ is held between $7.3x10^{-12}$-$1.8x10^{-9}$ M.
d) AgCl will precipitate if $[Ag^+] = 7.3x10^{-10}$ M.
e) Both Cl^- and I^- will precipitate at $[Ag^+]$ $7.3x10^{-12}$ - $1.8x10^{-9}$ M.

11. Calculate the pH of a solution that is 0.1 M of each Fe(III) and Mg(II), in which Fe(III) is needed to be separated quantitatively from the Mg(II) as hydroxide. Given that
K_{sp} for $Fe(OH)_3 = 5\times10^{-39}$
K_{sp} for $Mg(OH)_2 = 7.1\times10^{-12}$
Using 1×10^{-6} M as criterion for quantitative removal of ions

a) 3.23 b) 8.92 c) 5.07 d) 10.77 e) 2.47

12. 0.10M solution of an acid HC (pKa = 4.30) is titrated with 0.10 M NaOH, which is the most suitable indicator for this titration:

Indicator	pK_{in}
I (acid)	8
II (base)	5
III (acid)	10

a) I b) II c) III d) I or II e) II or III

13. 40.00 mL of 0.0900 M HCl is titrated with 0.1 M NaOH. Calculate the pH after addition of 30.00 mL of NaOH

a) 1.82 b) 2.34 c) 1.51 d) 2.07 e) 0.09

14. In the titration of 40.00 mL of 0.110 M NaOCL ($K_{a\ for\ HOCl} = 6.25x^{-10}$) with 0.100 M HCl. Calculate the pH after addition of 44.00 mL HCl.

a) 6.38 b) 5.24 c) 4.00 d) 3.21 e) 8.76

15. Which of the following acids would show the sharpst end point when 50.00 mL of 0.10M of the acid is titrated with 0.10 M NaOH:

a) Acid I with Ka =1 x 10^{-2}
b) Acid II with Ka =1 x 10^{-4}
c) Acid III with Ka =1 x 10^{-6}
d) Acid IV with Ka =1 x 10^{-8}
e) Acid V: very strong acid

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Analytical Chemistry
Second Exam

Name: .... Date: 19/12/2011

Reg. No.: ...01010411...... Seat no.:......................

Section: 1 2 3 4

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1.	a	b	c	d	e	9.	a	b	c	d	e
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5.	a	b	c	d	e	13.	a	b	c	d	e
6.	a	b	c	d	e	14.	a	b	c	d	e
7.	a	b	c	d	e	15.	a	b	c	d	e
8.	a	b	c	d	e						

GOOD LUCK

1. Calculate the molar solubility of $Fe(OH)_3$ ($K_{sp} = 5\times10^{-39}$) in water

a) 2.0×10^{-18} M b) 5.0×10^{-18} M c) 6.5×10^{-18} M d) 9.0×10^{-18} M
e) 8.0×10^{-18} M

2. Calculate the pH of a solution that is 0.1 M of each Fe(III) and Mg(II), in which Fe(III) is needed to be separated quantitatively from the Mg(II) as hydroxide. Given that
K_{sp} for $Fe(OH)_3 = 5\times10^{-39}$
K_{sp} for $Mg(OH)_2 = 7.1\times10^{-12}$
Using 1×10^{-6} M as criterion for quantitative removal of ions

a) 5.07 b) 8.92 c) 3.23 d) 10.77 e) 2.47

3. The molar solubility for $SrSO_4$ is highest when dissolved in a solution that has $[H_3O^+]$ of :

a) 2.50M
b) 1.50 M
c) 0.10 M
d) 0.20 M
e) 0.06 M

4. Which is the mass-balanced equation for a a solution that is 0.10 M in NaOH and saturated with $Zn(OH)_2$, which undergoes the reaction:

$Zn(OH)_2 + 2OH^- \rightarrow Zn(OH)_4^{2-}$

a) $0.10 = [Na^+] = [OH^-] + [Zn(OH)_4^{2-}]$
b) $0.10 = [Na^+] = [OH^-] - 2[Zn(OH)_4^{2-}]$
c) $0.10 = [Na^+] = [OH^-] - [Zn(OH)_4^{2-}]$
d) $0.10 = [Na^+] = [OH^-] + 2[Zn(OH)_4^{2-}]$
e) None of the above

5. Which is the correct charge – balance equation of solution containing 1M $Al_2(SO_4)_3$

a) $[Al^{3+}] + [H_3O^+] = 2[SO_4^{2-}] + [OH^-]$
b) $3[Al^{3+}] + [H_3O^+] = [SO_4^{2-}] + [OH^-]$
c) $3[Al^{3+}] + [H_3O^+] = 2[SO_4^{2-}] + [OH^-]$
d) $[Al^{3+}] + [H_3O^+] = [SO_4^{2-}] + [OH^-]$
e) None of the above

6. Calculate the molar solubility of CuS in a solution in which the $[H_3O^+]$ is held constant at 2.0×10^{-1} M . K_{sp} for CuS is 8×10^{-37}, and for H_2S $K_1 = 9.6 \times 10^{-8}$ and $K_2 = 1.3 \times 10^{-14}$

a) 3.5×10^{-12} M b) 5.1×10^{-9}M c) 3.2×10^{-8}M

d) 3.4×10^{-23}M e) 4×10^{-4}M

7. Generation of hydroxide ion as a precipitating agent from urea for the purpose of precipitating Fe^{3+} as $Fe(OH)_3$ is called:

a) peptization
b) precipitation from homogeneous solution
c) coagulation
d) digestion of the precipitate
e) coprecipitation

8. An aqueous solution contains $NaNO_3$ and KBr. The bromide ion was separated as AgBr by addition of excess precipitating agent $AgNO_3$. The charge on the surface of the coagulated colloidal precipitate is:

a) Positive charge due to the adsorption of potassium ions
b) Negative charge due to the adsorption of nitrate ions
c) Positive charge due to the adsorption of silver ions
d) Neutral since primary adsorption layer will neutralize the counter ions
e) Negative charge due to the adsorption of bromide ions .

9. Which of the following statements is correct:.
a) disperion of colloidal precipitates occurs when washed with distilled water.
b) inclusion means capturing of foreign ions into the space lattices of the crystal.
c) occlusion means entrapment of a solution droplet into the crystal during precipitation.
d) In gravimetric analysis positive error occurs if the crucible containing the precipitate is dried to constant weight.
e) the particle size decreases by decreasing the relative supersaturation ratio.

10. Treatment of a 0.2500 g of impure potassium chloride with an excess of $AgNO_3$ resulted in the formation of a 0.2912 g of AgCl (molar mass = 143.36 g/mol). Calculate the percentage of KCl (molar mass = 74.59 g/ mol) in the sample.

a) 60.6% b) 121.2 % c) 30.3 % d) 52.0 % e) 26.0 %

11. In Volhard method for the determination of I^- in an aqueous sample 20.00 mL of 0.10M $AgNO_3$ is added to 10.00 mL of an unkown I^- solution. The unreacted $AgNO_3$ is back titrated with 5.00 mL of 0.10 M KSCN using Fe^{3+}as indicator. Calculate the concentration of I^- in the unkown sample given that the atomic mass of I^- is 127.0 g/mol.

a) 25.40 g/L b) 0.15 g/L c) 6.35g/L d) 19.05 g/L e) 38.10 g/L

12. In the titration of 35.00 ml of 0.40 M of Na_2SO_4 with 0.20 M $Pb(NO_3)_2$, $PbSO_4$ precipitates down. Calculate the P function of Pb^{2+} (pPb) after adding 50.00 ml of $Pb(NO_3)_2$. K_{sp} for $PbSO_4$ is: 1.6×10^{-8}

a) 6.5 b) 7.11 c) 5.08 d) 3.89 e) 2.72

13. A solution of $HClO_4$ was standardized by dissolving 0.4125 g of primary standard grade HgO (molar mass = 216.59 g/mol) in a solution of KBr:

$$HgO(s) + 4\,Br^- + H_2O \rightarrow HgBr_4^{2-} + 2\,OH^-$$

The liberated OH^- consumed 46.51 ml of the $HClO_4$ solution. The molarity of the $HClO_4$ is:

a) 0.042 M
b) 0.021 M
c) 0.063 M
d) 0.082 M
e) 0.100 M

14. In the argentometric determination of bromide ion in an aqueous sample using Mohr's-method for the endpoint detection, the effect of carrying out accidently this titration at pH= 3 will have

a. positive error
b. negative error
c. There will be no effect on the reults of the titration.
d. Higher precipitate amount of Ag_2CrO_4 is formed.
e. Endpoint could not be detected

15. In titration of 50.00 mL of 0.050 M KI with 0.10 M $AgNO_3$, calculate pAg after addition of 25.00 mL of the $AgNO_3$ solution. Ksp for AgI is 1.7×10^{-17}.

a) 3.70 b) 16.77 c) 1.30 d) 6.58 e) 8.38

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Department of Chemistry
Analytical Chemistry
Second Exam

Date: Dec. 20, 2005

Name: ......حزام نبيل الدريني..........

Section: ...12:30 – 2:00

Reg. No.: ...0046199....

اسم المدرس: ....د. هنا رحنا ضي.....

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1.	a	b	c	d	e	9.	a	b	c	d	e
2.	a	b	c	d	e	10.	a	b	c	d	e
3.	a	b	c	d	e	11.	a	b	c	d	e
4.	a	b	c	d	e	12.	a	b	c	d	e
5.	a	b	c	d	e	13.	a	b	c	d	e
6.	a	b	c	d	e	14.	a	b	c	d	e
7.	a	b	c	d	e	15.	a	b	c	d	e
8.	a	b	c	d	e						

GOOD LUCK

1. The Ag^{+} (atomic mass 107.9 g/mol) in a solution is precipitated by the addition of Cl^{-} ion. The final volume of the solution is 500 mL. What should be the concentration of Cl^{-} if no more than 0.10 mg Ag^{+} remains unprecipitated? K_{sp} for AgCl = 1.0×10^{-10}

a) 2.68×10^{-4} M
b) 1.0×10^{-5} M
c) 5.00×10^{-7} M
d) 5.39×10^{-5} M
e) 3.1×10^{-8} M

2. What is the pH of a solution prepared by dissolving 3.30 g of NH_4Cl (molar mass 53.5 g/mol) in water, adding 125.0 mL of 0.0111 M NaOH and diluting to 500 mL. K_b for NH_3 is 1.75×10^{-5}.

a) 10.11
b) 7.56
c) 6.44
d) 7.00
e) 8.77

3. Which of the following acids would give the sharpest end point when 23.00 mL of 0.10 M of the acid is titrated with 0.10 M NaOH.

a) acid D with $K_a = 10^{-2}$
b) acid E with $K_a = 10^{-4}$
c) acid A with $K_a = 10^{-5}$
d) acid B with $K_a = 10^{-10}$
e) acid C with $K_a = 10^{-8}$

4. 100 mL, 0.036 M HCl solution is titrated with 0.100 M NaOH. Calculate the pH after addition of 35.95 mL of the titrant.

a) 3.01
b) 7.00
c) 4.43
d) 9.11
e) 8.11

5. Calculate the molar solubility of CuS in a solution in which $[H_3O^{+}]$ concentration is held constant at 1.0×10^{-1} M.
Given that K_{sp} for CuS = 8×10^{-37}
For H_2S $K_{a1} = 9.6\times10^{-8}$
$K_{a2} = 1.3\times10^{-14}$

a) 5×10^{-2} M
b) 7×10^{-35} M
c) 2.5×10^{-9} M
d) 4×10^{-7} M
e) 3×10^{-3} M

6. Coprecipitation in case of colloidal precipitates occurs by:

a) mechanical entrapment b) inclusion c) inclusion
d) surface adsorption
e) all of the above processes occur

7. A sample of a weak base B is titrated with 0.100 M HCl. 40.0 mL of titrant is required to reach the equivalence point. When 24.0 mL of titrant had been added, the pH was 5.84. Calculate pK_b of the weak base.

a) 5.84 b) 7.98 c) 8.11 d) 9.31 e) 5.67

8. Calculate the buffer capacity as moles of NaOH for a buffer consisting of 0.2 M NH_3 and 0.3 M NH_4Cl (K_b for $NH_3 = 1.75\times10^{-5}$)

a) 3.11×10^{-2} mol b) 6.5×10^{-2} mol c) 0.23 mol
d) 6.5×10^{-4} mol e) 1.1×10^{-3} mol

9. The type of mechanism by which crystalline precipitates form is:-

a) nucleation mechanism.
b) coprecipitation.
c) coagulation.
d) particle growth mechanism.
e) none of the above.

10. AgCl is precipitated by adding NaCl to an aqueous solution of $AgNO_3$. The ion most strongly absorbed to the surface of the colloidal precipitate before the equivalence point is:-

a) OH^- b) Na^+ c) Cl^- d) Ag^+ e) H_3O^+

11. The best wash solvent for $Fe(OH)_3$ gelatinous precipitate is:-

a) dilute ammonia solution b) pure water
c) acetone d) dilute HNO_3 solution
e) ethanol

12. A 4.476 g sample of a petroleum product was burned in a tube furnace, and the SO_2 (molar mass 64 g/mol) produced was collected in 3% H_2O_2. Reaction is:-

$$SO_{2(g)} + H_2O_2 \rightarrow H_2SO_4$$

A 25.00 mL portion of 0.00923 M NaOH was introduced into the solution of H_2SO_4. Reaction is:

$$H_2SO_4 + 2\,NaOH \rightarrow Na_2SO_4 + 2\,H_2O$$

following which the excess base was back titrated with 13.33 mL of 0.01007 M HCl. Calculate the parts per million of sulfur (atomic mass 32 g/mol) in the sample.

a) 345.0 ppm   b) 0.345 ppm   c) 300.0 ppm
d) 175.0 ppm   e) 115.0 ppm

13. Which of the following indications is most suitable for the titration of 50.00 mL of 0.10 M acetic acid ($K_a = 1.75\times10^{-5}$) with 0.10 M NaOH.

	Transition range
a) Alizarin yellow	10.0 – 12.0
b) Thymol blue	1.2 – 2.8
c) phenol red	6.2 – 2.8
d) cresol purple	7.6 – 9.2
e) Thymol phthalein	9.3 – 10.5

14. 0.7500 g sample containing only NaCl (molar mass 58.34 g/mol) and NaBr (molar mass 102.89 g/mol) was treated with excess $AgNO_3$. The mixture AgCl (molar mass 143.34 g/mole) and AgBr (molar mass 187.78 g/mol) is filtered, washed, dried and found to weigh 1.5220 g. Calculate the percentage of NaCl in the sample?

a) 68.11%   b) 16.76%   c) 32.34%   d) 64.64%   e) 4.01%

15. The process of dispersing an insoluble material into a liquid as a colloid is called:

a) peptization   b) occlusion   c) inclusion
d) coagulation   e) nucleation