16 مراجعة سؤال

UNIVERSITY OF JORDAN
Analytical Chemistry 0303211
Hour Exam I

DEPARTMENT OF CHEMISTRY
Summer semester 2011/2012
Saturday June 30, 2012

Student Name : ....
Registration No. ....
Seat number: ....59...
Instructor: ......د. [illegible] الجوراني...

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ANSWER SHEET

1	a	b	~~c~~	d	e	11	a	b	~~c~~	d	e
2	a	b	c	d	~~e~~	12	a	b	c	~~d~~	e
3	a	b	c	d	~~e~~	13	a	b	~~c~~	d	e
4	a	~~b~~	c	d	e	14	a	~~b~~	c	d	e
5	~~a~~	b	c	d	e	15	a	b	c	~~d~~	e
6	a	b	c	~~d~~	e	16	a	b	c	d	~~e~~
7	a	~~b~~	c	d	e	17	a	b	c	d	~~e~~
8	a	b	~~c~~	d	e	18	a	b	~~c~~	d	e
9	a	~~b~~	c	d	e	19	a	b	c	d	~~e~~
10	a	b	c	~~d~~	e	20	~~a~~	b	c	d	e

CONFIDENCE LEVELS FOR VARIOUS VALUES OF Z	
CONFIDENCE LEVEL, %	Z
50	0.67
68	1.00
80	1.29
90	1.64
95	1.96
96	2.00
99	2.58
99.7	3.00

Values of t for Various Levels of Probability				
Degrees of Freedom	Factor for Confidence interval,			
	80%	90%	95%	99%
1	3.08	6.31	12.7	63.7
2	1.89	2.92	4.30	9.92
3	1.64	2.35	3.18	5.84
4	1.53	2.13	2.78	4.60
5	1.48	2.02	2.57	4.03
6	1.44	1.94	2.45	3.71

CRITICAL VALUES FOR REJECTION QUOTIENT Q			
Number of Observations	Qcritical		
	90% Confidence	95% Confidence	99% Confidence
3	0.94	0.98	0.99
4	0.76	0.85	0.93
5	0.64	0.73	0.82
6	0.56	0.64	0.74
7	0.51	0.59	0.68
8	0.47	0.54	0.63

1. An interference or interferent is a substance that
   a) Exists in the matrix but does not affect the results of analysis
   b) is used in some methods for analysis of the analyte.
   c) affects the measured analytical signal for the analyte and leads to error in the analysis results.
   d) affects taking a sample for analysis.
   e) None of the above

2. A sample in which the concentration of the analyte is equal to the average concentration of the analyte from the site where the sample is taken is called
   a) Pure sample
   b) Representative sample
   c) Excellent sample
   d) Replicate sample
   e) None of the above

3. A 0.3700 g of KCl (molar mass = 74.54 g/mole) is dissolved in water such that the final volume of the solution is 50.00 mL. Calculate the molar concentration of K^+ in this solution
   a) 1.0×10^{-5} M
   b) 0.100 M
   c) 0.0500 M
   d) 0.200 M
   e) 0.0100 M ✓

$\frac{0.3700}{74.54}$

$KCl \rightarrow K^+ + Cl$

0.01 0

0 0.01

4. A 0.500 M solution of a weak acid HA is known to be 90.0% ionized at this concentration. The equilibrium (or species) concentration of HA in the solution is
   a) 0.550 M
   b) 0.0500 M
   c) 0.450 M
   d) 0.100 M
   e) 0.900 M

$HA \rightarrow H^+ + A^-$

5. A 1.922×10^{-4} M $K_3Fe(CN)_6$ (molar mass = 329.115 g/mole) can be expressed in parts per million as
   a) 63.3 ppm
   b) 45.6 ppm
   c) 29.7 ppm
   d) 77.8 ppm
   e) 37.1 ppm

ppm = $\frac{\text{mass solute}}{\text{V solution}}$

6. Calculate the molar concentration of Zn^{2+} in a solution that has a pZn value of 3.875

$10^{-3.8}$

a) $7.78 x 10^{-6}$ M
b) $4.45 x 10^{-3}$ M
c) $6.66 x 10^{-5}$ M
d) $1.33 x 10^{-4}$ M
e) $9.56 x 10^{-2}$ M

7. Calculate the molar concentration of concentrated $HClO_4$ (molar mass = 100.46 g/mole) in a solution that has a specific gravity of 1.67 and is 70.0% $HClO_4$ (w/w).

a) 5.55 M
b) 11.6 M
c) 14.5 M
d) 9.98 M
e) 4.78 M

8. In titrations, the color change of a chemical indicator requires an overtitration of 0.04 mL. The type of error in this case is

a) ~~Gross error~~
b) Instrumental error
c) Personal error
d) ~~Method error~~
e) ~~Random error~~

9. A method of analysis yields weights for gold that are low by 0.4 mg. Calculate the percent relative error caused by this error in the weight of gold in a sample is 45 mg

$\frac{45 - 0.4}{0.4}$

a) 2.22%
b) 0.089%
c) 0.89%
d) 8.88%
e) 4.44%

10. Consider the following data obtained for the weight of a sample of natural uranium ores:

0.105, 0.102, 0.106, 0.101, 0.999, 0.100 g

The median for these data is

0.0999, 100, 101, 102, 105, 106

a) 0.1050
b) 0.1010
c) 0.1020
d) 0.1015
e) 0.1060

11. Independent analysis is a procedure for detection of systematic method error. This procedure involves

a) Exploration of the dependence of the magnitude of the error on the sample size
b) Analysis of a standard sample
c) Analysis of the sample by a different method
d) Blank determination
e) None of the above

12. Random errors

a) Occur occasionally due to laziness of the experimentalist
b) Can be determined and compensated for
c) Can be related to specific perceptible sources
d) Are due to combination of small unperceptible errors
e) None of the above

13. Analysis of several plant-food preparations for potassium ion yielded the following data:

Sample	Percent K^+	$\bar{x}$	
1	5.15, 5.03, 5.04	5,07	0.0064 + 0.0016 + 0.0009
2	7.18, 7.17, 6.97	7.11	0.0049 + 0.0036 + 0.0196
3	4.00, 3.93, 4.15	4,03	0.0009 + 0.01 + 0.0144

Calculate a pooled value of the standard deviation, s_{pooled}.

a) 0.003
b) 0.01
c) 0.1
d) 0.001
e) 0.04

$\sqrt{\frac{0.}{6}}$ $\frac{0.0253 + 0.0281 + 0.0274}{}$

$\frac{0.0618}{6}$

14. Estimate the standard deviation in the following calculation and report the result of computation.

$Y = 90.31(\pm 0.08) - 89.32(\pm 0.06) + 0.200(\pm 0.004)$

$S_y =$

$y = a\,(\pm a) + b\,(\pm b)$

a) 1(±1)
b) 1.19 (±0.01)
c) 1.2(±0.1)
d) 1.190(±0.001)
e) 1.1900(±0.0001)

15. Six bottles of orange juice samples were analyzed for residual sugar contentwith the following results:

$\bar{x}$

No. of samples	6
Average percent concentration of sugar	2.45 $\bar{x}$
Standard deviation	0.03 s

Calculate the coefficient of variation for the results of analysis.

$\frac{s}{\bar{x}} \times 100\%$

$\frac{0.03}{2.45}$

a) 0.3%
b) 0.012
c) 1.2%
d) 12.2 ppt (ppt = part per thousand)
e) 9×10^{-6}

16. Perform the following mathematical operation and round the answer so that only the significant figures are retained
log (4.000×10^{-5}) =
a) -4.39790
b) -4.4
c) -4.39
d) -4.398
e) -4.3979

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17. A chemist determined the percentage of iron in an ore, obtaining the following results: $\bar{x} = 15.30$, $s = 0.10$, $n = 4$.
Calculate the 90% confidence limits of the mean for these data.

$z \quad \frac{ts}{\sqrt{n}}$

a) 15.30 ± 0.33
b) 15.30 ± 0.29
c) 15.30 ± 0.16
d) 15.30 ± 0.41
e) 15.30 ± 0.12

$S = 0.07$

18. The standard deviation of a method for determining manganese in steel is known from a large number of determinations to be 0.07. How many determinations must be run by this method if the 90% confidence interval of the mean is to be ± 0.06?

a) 12
b) 2
c) 4
d) 6
e) 9

$\frac{Z\sigma}{\sqrt{N}}$

$0.06 = \frac{1.64 \cdot 0.07}{\sqrt{N}}$

19. Apply the Q-test to the following data to determine which result should be rejected at the 95% confidence level 7.295, 7.284, 7.388, 7.292.

7.284 / 7.292 / 7.295 / 7.388

a) 7.292
b) 7.295
c) 7.388
d) 7.284
e) none of the results should be rejected.

20. The confidence interval is an interval around the experimental mean within which:
a) the true value exists
b) the population mean exists within $\pm\sigma$ bounds
c) the population mean exists within $\pm 2\sigma$ bounds
d) the population mean exists with a certain probability
e) the population mean exists with 100% probability.

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فارنياض

$\frac{11}{15}$

$\boxed{\frac{22}{30}}$

Analytical Chemistry
First Exam

Name: ....علا محمود العلاد.............. Date: 20/3/2012

Reg. No.: ...0101200...........Seat no.:.....................

Section: 1 2 3 4

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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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$M = \frac{d \times \% \times 10}{Mw}$ 1 $M_1 V_1 = M_2 V_2$

$M_1 \times 16.7 \times 10^{-3} = 2.00 \times 0.169$

$d = \frac{M \times Mw}{\% \times 10} = \frac{20.24 \times 40.}{10 \times 53.4} =$ $M = 0.020239 \times 10^3$ M_1 20.24 $\frac{809.6}{} = 15.16$

$d = 1.52.$

1. What is the density of 53.4 wt % aqueous NaOH (MW = 40.00) if 16.7 mL of the solution diluted to 2.00 L gives 0.169 M NaOH.

a)15.2g/mL b) 0.169g/mL c) 3.03g/mL d) 0.75g/mL e)1.52 g/mL

1.4×10^{-5} 2.8×10^{-5} $M \times 10^6$ = 28.

2. 500 mL of a water sample is found to contain 0.0014 g of $CaCO_3$(molar mass 100.1 g/mol). Calculate the concentraion of $CaCO_3$ in parts per million.

$n_{CaCO_3} = \frac{m}{Mw} = 1.4 \times 10^{-5}$

$M = \frac{n}{V} = \frac{1.4 \times 10^{-5}}{0.5} \times 10^6$

$= 2.8 \times 10^1$

28 ppm.

a)2.8 ppm b) 0.0014ppm c) 1.4 ppm d) 0.028 ppm e) 0.14 ppm

25 - 10 = $\boxed{15 ml}$ $n = 5 \times 10^{-3}$

3. What volume of water should be added to 10.0 mL of a 0.500 M solution of NaCl to make the molarity 0.200M. Assume volumes are additive.

$\frac{1.9 \times 10^{-5}}{5 \times 10^{-3}} \times 10^{6}$

$= 0.0028 \times 10^{-2}$ $\times 10^4$

a)25 mL b) 15 mL c) 40mL d) 10mL e) 5mL

$M_1 V_1 = M_2 V_2$

$0.5 \times 10.0 ml = 0.2 \times V_2$

$\boxed{V_2 = 25 ml}$

4. The molarity of an NaOH solution was determined by titration vs. KHP. Individual titrations gave the following concentrations: 0.1127M, 0.1112M, 0.1132M, 0.1134M and 0.1174M. Which of these points should be rejected at the 95% confidence interval?

0.1112 < 0.1127 < 0.1132 < 0.1134 < 0.1174

$\frac{0.0015}{0.0062} = 0.24$

$Q_1 = \frac{0.1174 - 0.1134}{0.1174 - 0.1112} = \frac{0.004}{0.0062}$

a) 0.1127 b) 0.1112 c) 0.1174 d) 0.1134 e) none of the above.

$Q_{cal} = 0.65$

5. This particular analysis (in question 4) has been performed thousands of times - enough such that the population standard deviation (Б) can be determined. Assuming that Б is equal to 0.0003M for this determination, calculate the 95% confidence interval for µ

CI for $\mu = \bar{x} \pm \frac{6z}{\sqrt{N}}$

a) 0.1136± 0.00026 b) 0.1136 ± 0.0003 c) 0.114±0.0003
d) 0.114±0.00026 e) 0.1126± 0.0003

$0.1136 \pm \frac{0.0003 \times 1.96}{\sqrt{5}}$

$\pm \frac{0.000588}{2.24}$

± 0.00026

6. For the following calculations, determine the answer and the appropriate uncertainty:

$y = 8.4$ $S_y = \sqrt{(S_a)^2 + (S_b)^2}$ (8.4 ± 0.5)

$(0.3)^2 + (0.4)^2$

15.4(±0.3) -7.0(±0.4)

$= 0.09 + 0.16$

± 0.5

a) 8.4±0.7 b) 8.4±0.1 c) 8.4 ± 0.5 d) 8.40 ± 0.70 e) 8.40 ± 0.50

7. For the following calculations, determine the answer and the appropriate uncertainty:

$\frac{S_y}{y} = 2.303\, S_a$

$= 2.303 \times 0.04$

antilog 6.44±0.04 2,754,228.703 = $2.8 \times 10^6 \pm 0.2$

$S_y = 0.2487$

0.3

a)(2.8±0.3) x 10^6 b) 2.8 x 10^6 c) (2.80±0.3) x 10^6
d) 2.80x 10^6 e) (2.80±0.30) x 10^6

10.0% ←
0.4% ← 0.1

$\frac{0.4 \times 10^{-3}}{0.1} \times 100\%$
$= 0.4\% \rightarrow 10.0\% = 4\%$

8. In a certain method for determining silica, SiO_2 is precipitated and weighed. It is found that the amount of SiO_2 obtained is always 0.4 mg too high regardless of the weight of sample taken for analysis. Calculate the % error in a sample which contains 10.0% SiO_2 if the sample analyzed is 0.100 g.

$\% = \frac{+0.4}{0.1} \times 100\%$ $\frac{x_i - x_t}{x_t}$
$= 400\%$
$0.100\ g \rightarrow 10.0\%$

a) 40% b) 0.4% c) 10% d) 0.04% e) 4%

9. Titrator A obtains a mean value of 24.32% and a standard deviation of 0.12 for the purity of a compound. Titrator B obtains corresponding values of 24.52% and 0.10. The true value is 24.40 %. Compared with titrator B, titrator A is:

$\frac{x_i - x_t}{x_t}$ = ① RSD
RSD↓ more precise.

$\frac{24.32 - 24.40}{24.40} = \frac{0.08}{24.4} = -0.00327$
$\frac{24.52 - 24.40}{24.40} = \frac{0.12}{24.4} = 0.0049$
pe low
loow

a) less accurate but more precise
b) more accurate and less precise
c) less accurate and less precise
d) more accurate but more precise
e) no information about accuracy and precision could be obtained from the given information.

10. Calculate the pH of a 0.050 M solution of acetic acid. The Ka of acetic acid is 1.8×10^{-5}.

$H = \sqrt{KaC}$ $\sqrt{0.09 \times 10^{-5}} = \sqrt{0.9 \times 10^{-6}}$
$H^+ = 0.95 \times 10^{-3}$
$= 9.5 \times 10^{-4}$
pH = 3.02

a) 4.50 b) 0.65 c) 5.05 d) 7.00 e) 3.02

11 . Calculate the pH of a solution that is 0.10 M in sodium acetate.Ka for acetic acid is 1.8×10^{-5} :

$K_b = \frac{1 \times 10^{-14}}{1.8 \times 10^{-5}} = 0.56 \times 10^{-9}$
$= \sqrt{0.056 \times 10^{-9}}$
$\sqrt{0.56 \times 10^{-10}}$
$OH = 0.75 \times 10^{-5}$
$= 7.5 \times 10^{-6}$
$P(OH) = 5.12$
$pH = 8.88$

a) 8.88 b) 1.00 c) 7.00 d) 5.2 e) 9.30

$Ag_2CrO_4 \rightarrow 2Ag^+ + CrO_4^{-2}$ (x; 2x; x)

12. The solubility of silver chromate(molar mass 332 g/mol) at 25^{0}C is 0.0279 g/L. Calculate the value of K_{sp} for Ag_2CrO_4

$H = 332\ \frac{g}{mol} \times 0.027\ \frac{g}{L}$
$\frac{0.0279\ g/L}{332\ g/mol}$
$\boxed{H = 8.4 \times 10^{-5}}$

a)2.9×10^{-8} b) 1.1×10^{-12} c) 7.8×10^{-4} d) 2.4×10^{-12} e)5.9×10^{-13}

$K_{sp} = [Ag^+]^2 + [CrO_4]$
$= (2 \times 8.4 \times 10^{-5})^2\ (8.4 \times 10^{-5})$
$16.8 \times 10^{-10} \times 8.4 \times 10^{-5} = 141.12 \times 10^{-15}$
282.24
$= 2370.816 \times 10^{-15}$
2.4×10^{-12}

13. Consider the dissociation of barium sulfate ($BaSO_4$: $K_{sp} = 1.1 \times 10^{-10}$)
Calculate the molar solubility of $BaSO_4$ in water :

$BaSO_4 \rightarrow Ba + SO_4^-$
$1.1 \times 10^{-10} =$ x x
$\sqrt{x^2} = \sqrt{1.1 \times 10^{-10}}$
$= 1.05 \times 10^{-5}$

a) 1.0×10^{-3}M b) 1.1×10^{-10} M c) 1.0×10^{-6}M
d)7.0×10^{-5} M e) 1.0×10^{-5}M

14. Calculate the pH of a solution prepared by mixing 100 mL of 0.05 M NaOH with 100 mL of 0.175M acetic acid (CH_3COOH). Ka for CH_3COOH is 1.8×10^{-5} $k_b = 0.56 \times 10^{-9}$

a) 1.3 b) 12.7 c) 4.4 d) 9.6 e) 7.0

15. Which of the following solutions is the most acidic solution:

a) pH = 10 b) $[OH]^- = 10^{-12}$ M c) pH = 5 d) $[H_3O]^+ = 10^{-6}$ M e) pOH = 7

$H^+ = 10^{-2}$ $pH = 6$

$pH = 2$

NaOH

$M = 0.05$

$V = 100$ ml

limiting $n = 0.005$ lim

CH_3COOH HA

$= 0.175$

$= 100$ ml

$n = 0.0175$

basic

$ka = 1.8 \times 10^{-5}$ CH_3COOH

$\boxed{0.005}$

$NaOH + CH_3COO \rightarrow CH_3COONa + H_2O$

$1 \rightarrow 1$

$0.005 \rightarrow 0.005$

$pOH = \sqrt{Pk}$

$pOH = \sqrt{Kb \times [salt]}$

n $[CH_3COONa] = 0.005$

$M = \frac{0.005}{200 \text{ ml}}$

$= \frac{0.005}{0.2}$

$= 0.025$

$\sqrt{0.56 \times 10^{-9} \cdot [0.05) \times 0.025}$

0.014×10^{-9}

0.14×10^{-10}

$[OH] = 0.37 \times 10^{-5}$

pH 3.7×10^{-6}

$pOH = 5.43$

$pH = 8.58$

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

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

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

Critical 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	$\boxed{0.710}$	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

N=5
C = 95%
Q cal = 0.65
Q crit = 0.710

Qcal < Qcri
retained.

12/15

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سيطول الليل ... فلا تحزن ^^
فالليل وإن طال سيرحل

Analytical Chemistry
Second Exam

Name: ......عبد الغني ابراهيم العلاو........ Date: 30/4/2012

Reg. No.: ....0101200........Seat no.:......................

Section: 1 2 3 4

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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

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غيرنا حتى نكمل

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.

$n\ Na_2C_2O_4 = 2.13 \times 10^{-3} \rightarrow 45.12$ ml $KMnO_4$

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. $n\ Na_2C_2O_4 = 0.092 \times 10^{-3}$

Equation is:

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

$2\ MnO_4 \rightarrow 5\ C_2O_4$
$?? \rightarrow 2.13 \times 10^{-3}$
$\boxed{n\ MnO_4 = 0.852 \times 10^{-3}}$

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

$n\ MnO_4 = 0.0368 \times 10^{-3}$
$\boxed{= 0.8882 \times 10^{-3}}$
45 ml
$M = \frac{n}{V} =$
$\boxed{M = 0.0197}$

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 $AgNO_3$ eq. point

K_{sp} for AgCl = 1×10^{-10} $\sqrt{Ksp}$ $Cl^- = 1 \times 10^{-5}$ = pCl = 5

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

acidic.

9. Chloride ions are to be determined by titration in a solution of pH 1.5. Which method would give the best results:- H_3O^+

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.

$Ag = \frac{1.8\times10^{-10}}{0.1} = 18\times10^{-10}$ 1.8×10^{-9}

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 = 1.8×10^{-10}, K_{sp} for AgI is 7.3×10^{-17} and using 1×10^{-5} M as a criterion for quantitative precipitation, which of the following statements is correct:-

AgI prec first
$I^- = 1\times10^{-5}$
$7.3\times10^{-17} / 1\times10^{-5} = [Ag]\times10^{-5}/10^{-5}$
$\boxed{[Ag] = 7.3\times10^{-12}}$

a) separation is not feasible.
b) I^- can be separated if $[Ag^+]$ is less than 7.3×10^{-12} M.
c) I^- can be separated from Cl^- if $[Ag^+]$ is held between 7.3×10^{-12}-1.8×10^{-9} M.
d) AgCl will precipitate if $[Ag^+] = 7.3\times10^{-10}$ M.
e) Both Cl^- and I^- will precipitate at $[Ag^+]$ 7.3×10^{-12} - 1.8×10^{-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

$OH = \sqrt[3]{\frac{5\times10^{-39}}{0.1}} = \sqrt[3]{50\times10^{-39}} = 3.68\times10^{-13}$ → ترسب بالاول
$OH = \sqrt[2]{\frac{7.1\times10^{-12}}{0.1}} = \sqrt{71\times10^{-12}} = 8.42\times10^{-6}$ pOH = 5. pH = 8.9
$OH_3 = \sqrt[3]{\frac{5\times10^{-39}}{1\times10^{-6}}}$
$OH^3 = 1.7\times10^{-11}$
$OH = \sqrt{7.}$
pH = 3.23

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

weak acid. pH = 4.3. pH = pka . 0.1/0.1

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

8.5

pH = Pka ± 1
pH = 7 → 8
6
pH = 11.3 → 5.3
7.3.
HC + NaOH → NaC + H
0.1 0.1 0.1N
$[OH^-] = \sqrt{kb \text{ of base}}$
$= \sqrt{\frac{Kw}{ka}\cdot\frac{0.1}{2}}$

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

pka = -log [ka] = 4.3
ka = 5.0×10^{-5}.
= pk ± 1
$OC = \sqrt{0.1\times5.\times10^{-5}}$
$= 2.2\times10^{-3}$
4

الجواب
a

$H_3O^+ = \frac{n\,HCl - n\,NaOH}{tV} = \frac{3.6 - 3}{70} = 8.57 \times 10^{-3}$

2.07

strong — s 36 eq.pt

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

before.

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

weak base strong acid.

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

44 - eq. point.

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.

very strong acid is true.

$\sqrt{Ka\ \mathrm{Cl}}$.

$H_3O^+ = \sqrt{Ka\ \frac{n\,HCl}{V\,Tot}}$

$= \sqrt{\cancel{44 \times 10^{-4}}}$

$\sqrt{6.25 \times 10^{-10} \times \frac{4.4 \times 10^{-3}}{84 \times 10^{-3}}}$

$= \sqrt{\ }$

$= 0.57 \times 10^{-5}$

$H_3O^+ = 5.7 \times 10^{-6}$

$= 5.24.$

Activity Coefficients for Ions at 25 °C

Ion	α_X, nm	0.001	0.005	0.01	0.05	0.1
		Activity Coefficient at Indicated Ionic Strength				
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^-, Cu^+	0.4–0.45	0.965	0.927	0.902	$\boxed{0.82}$	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	$\boxed{0.81}$	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

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

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

Critical Values for the Rejection Quotient, Q*

Number of Observations	90% Confidence	95% Confidence	99% Confidence
	Q_{crit} (Reject if $Q > Q_{crit}$)		
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

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غيرنا وتميزنا ♥

Quiz 1

Name: علا محمود الحداد   0101200

10

1. Which of the following sentences is not correct?

a) As a solution approaches infinite dilution, the activity coefficient approaches 1.
b) Activity coefficient of an uncharged molecule is approximately unity regardless of ionic strength.
c) In a solution that is not too concentrated, the activity coefficient of a given ion is independent of the nature of the electrolyte and dependent only on the ionic strength.
d) At any given ionic strength, the activity coefficient of ions of the same charge are approximately equal.
e) For a given ionic strength, the activity coefficient of an ion becomes closer to unity as the charge carried by the ion increases.

2. Which is the mass-balanced equation for a saturated solution of CaF_2?

Useful equations:

$CaF_2 \rightarrow Ca^{2+} + 2F^-$

$F^- + H_2O \rightarrow HF + OH^-$

$[Ca] = \frac{1}{2}[F^-]$

$[F^-] = [HF]$

$Ca^{+2} = \frac{1}{2}[F^-] + [HF]$

a) $[Ca^{2+}] = \frac{1}{2}\{[F^-] - [HF]\}$
b) $[Ca^{2+}] = \frac{1}{2}\{[F^-] + [HF]\}$
c) $[Ca^{2+}] = 2[F^-] + [HF]$
d) $[Ca^{2+}] = 2[F^-] - [HF]$
e) All of the above

$NaHA \rightarrow Na^+ + HA^-$

$H_2O \rightarrow H_3O^+ + OH^-$

$[Na^+] + [H_3O^+] = [HA^-] + [OH^-]$

$HA^- + H_2O \rightarrow H_2A + OH^-$

3. Write down the charge – balance equation for a solution containing 0.10 M NaHA

a) $[Na^+] = [HA^-] + 2[A^{2-}] + [OH^-]$
b) $[Na^+] + [H_3O^+] = [HA^-] + 2[A^{2-}] + [OH^-]$
c) $[Na^+] = [HA^-]$
d) $[Na^+] + [H_3O^+] = [HA^-] + [A^{2-}] + [OH]$
e) $2[Na^+] + [H_3O^+] = [HA^-] + 2[A^{2-}] + [OH^-]$

$Cu^{+2} = [S^{-2}] + 1.5\times10^{14}[S^{-2}] + 3.125\times10^{-4}[S^{-2}]$

4. 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) 4×10^{-4}M b) 5.1×10^{-9}M c) 3.2×10^{-8}M d) 3.4×10^{-23}M e) 3.5×10^{-12}M

$Cu^{+2} = [S^{-2}](1 + 3.2\times10^{19} + 15\times10^{-12})$

$K_{sp} = [S^{-2}](1+3.2\times10^{19} + 15\times10^{-12})[S^{-2}]$

$[S^{-2}] = \sqrt{\frac{1+3.2\times10^{19}+15\times10^{-12}}{8\times10^{-37}}}$

$CuS \rightarrow Cu^{+2} + S^{-2}$

$K_{sp} = [Cu^{+2}][S^{-2}] = 8\times10^{-37}$

$H_2S + H_2O \rightleftharpoons HS^- + H_3O^+$ ka

$HS^- + H_2O \rightarrow S^{-2} + H_3O^+$

$ka_1 = \frac{[HS^-][H_3O^+]}{[H_2S]}$

$\boxed{[H_2S] = \frac{[HS^-][H_3O^+]}{ka_1}} \rightarrow = \frac{[S^-][H_3O^+][H_3O^+]}{ka_1\, ka_2}$

$\boxed{H_2S = \frac{[S^-][H_3O^+]^2}{ka_1\, ka_2}}$

$\boxed{[Cu^{+2}] = [S^{-2}] + [H_2S] + [HS^-]}$

$= [S^{-2}] + \frac{[S^-][H_3O^+]^2}{k_1 k_2} + \frac{[S^{-2}][H_3O^+]}{k_2}$

$ka_2 = \frac{[S^{-2}][H_3O^+]}{[HS^-]}$

$\boxed{[HS^-] = \frac{[S^-][H_3O^+]}{k_2}}$

$= [S^{-2}]\left(1 + \frac{0.04}{12.48\times10^{-22}} + \frac{0.2}{1.3\times10^{-14}}\right)$

$= [S^{-2}](1 + 0.003205\times10^{22} + 0.15\times10^{14})$
$1 + 3205 \quad + 15$

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غيرنا وحنكمل

Quiz 1

Analytical Chemistry

Name........علا عمود الدار........

Reg. No........0101200........

1. Calculate the pOH at the equivalence point for the titration of 0.10M acetic acid with 0.10 M NaOH given that Ka for acetic acid (CH_3COOH) = 1.8 x10^{-5}.

a) 9.9 b) 7 c) 8.7 d) 5.3 e) 6.5

2. 40.00 mL of 0.0900 M HCl is titrated with 0.1 M NaOH. Calculate the pOH after addition of 30.00 mL of NaOH

a) 1.82 b) 2.34 c) 1.51 d) 2.07 e) 11.93

3. In the titration of 40.00 mL of 0.110 M NH_3 (K_b = 1.6x10^{-5}) with 0.100 M HCl. Calculate the pOH at the equivalence point.

a) 6.38 b) 4.38 c) 5.24 d) 3.21 e) 8.76

4. Which solution would provide the least sharp end point in the titration of 0.10 M HCl:

a) 0.10 M NH_3 b) 0.10 M NaOH solution c) 0.01 M NaOH solution d) 0.01 M NH_3 solution e) 0.10 M acetic acid solution

5. Calculate the initial pH in the titration of 50.00 mL 0.05M HCl solution with 0.10 M NaOH:

a) 1.3 b) 1.0 c) 7.0 d) 2.0 e) 13.0

pH = -log [0.05]

Biology union =) & BSS :)

إن السعادة تكمن في متعة الإنجاز
ونشوة المجهود المبدع ..
اتحاد الطلبة ٢٠١٣م

Quiz 1 (mid exam)
Analytical Chemistry
(سايرة لحصص التعلم)
Principles of Neutralization Titration

Name.....[redacted].................

2/5

Reg. No...............0101061.................................

1. Calculate the pOH at the equivalence point for the titration of 0.10M acetic acid with 0.10 M NaOH given that Ka for acetic acid (CH_3COOH) = 1.8×10^{-5}.

a) 9.9 b) 7 c) 8.7 d) ~~5.3~~ e) 6.5

2. 40.00 mL of 0.0900 M HCl is titrated with 0.1 M NaOH. Calculate the pOH after addition of 30.00 mL of NaOH

a) 1.82 b) 2.34 c) 1.51 d) 2.07 e) 11.93

3. In the titration of 40.00 mL of 0.110 M NH_3 ($K_b = 1.6 \times 10^{-5}$) with 0.100 M HCl. Calculate the pOH after addition of 44.00 mL HCl.

a) 6.38 b) 4.38 c) 5.24 d) 3.21 e) 8.76

4. Which solution would provide the least sharp end point in the titration of 0.10 M HCl:

a) 0.10 M NH_3 b) 0.10 M NaOH solution c) 0.01 M NaOH solution d) ~~0.01 M~~ NH_3 solution e) 0.10 M acetic acid solution

5. Calculate the initial pH in the titration of 50.00 mL 0.05M HCl solution with 0.10 M NaOH:

a) 1.3 b) 1.0 c) 7.0 d) 2.0 e) 13.0

لا تخف من المسافة بين الحلم والحقيقة ...
فما دمت استطعت أن تحلم بشيء .. فبإمكانك تحقيقه
بيلفا دافيز

Analytical Chemistry
First Exam (Theory) 28/30

Name: ....أسيل رياض جريسات...... Date:

Reg. No.: .0101167.........Seat no.:.....................

Section: 1 2 3 4

****

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

$M = \frac{d * \% * 10}{Mw} = \frac{1.149 * 12.5 * 10}{134}$

1. A 12.5% (w/w) $CuCl_2$ (134.6gmol^{-1}) solution has a density of 1.149gml^{-1}. Calculate the equilibrim concentration of Cl^- in this solution.

a) 0.986M b) 0.0782M c) 0.870M d) 0.192M e) 2.134M

$\rightarrow 1.08 \times 10^3$ mg

2. Brine water contains an average of 1.08×10^3 ppm of Na^+ (molar mass 23 g /mol), given that the density of the brine is 1.06 g/mL, Calculate the equilibrium molar concentration of Na^+:

$M = \frac{d * \% * 10}{Mw}$

a) 1.01 M b) 0.0500 M c) 0.0925 M d) 0.0759M e) 0.0369 M

$\frac{1.0\cancel{8 \times 10} \times 10}{23}$

1 Liter sol

1.08 g

3. Calculate the p-value of ClO_4^- in a solution that contains 3.35×10^{-4} M in $Ba(ClO_4)_2$ and 6.75×10^{-4} M in $HClO_4$.

1.345×10^{-3}

p ClO_4^- = $-\log$ ~~6.75e07~~

a) 2.87 b) 6.70 c) 3.98 d) 4.60 e) 2.13

4. A solution was prepared by dissolving 7.56 g of $KCl.MgCl_2.6H_2O$ (molar mass = 277.85 g/mol) in sufficient water to give 3.00 L solution. Calculate the ppm of Mg^{2+} (molar mass=24.3 g/mol)

a) 220.4 b) 304.1 c) 20.9 d) 150.1 e) 73.5

$9.06 \times 10^{-3} = \frac{\text{moles}}{\cancel{24.3}\ 3}$

5. When a 30.0 mL of 0.3757 M solution of Na_3PO_4 were mixed with 100.0 mL of 0.5151 M $Hg(NO_3)_2$, calculate the molarity of the unreacted species (Na_3PO_4 or $Hg(NO_3)_2$) after the reaction was complete:
$2PO4^{2-} + 3 Hg^{2+} \rightarrow Hg_3(PO_4)_2$

$NaNO_3 + Hg_3PO_4$

$\overset{+1}{Na_3}\overset{-3}{PO_4}$ $\overset{+2}{Hg}\overset{-1}{NO_3})_2$

,0112 ,05151

a) 0.0917M b) 0.2663 M c) 0.118 M
d) 3.20×10^{-2} M e) 8.23×10^{-5} M

6. The correct statement among the following is:

a) Constant errors have the same absolute magnitude regardless of sample size.
b) All analytical measurements have determinate errors.
c) Random errors are evaluated by the closeness of measured values to the true value.
d) Determinate errors are mathematically expressed by the CV(s%).
e) Proportional errors have the same absolute magnitude regardless of the sample size

7. Suppose that 0.1 mg of a precipitate was lost as a result of being washed with 300 mL of wash liquid. If the precipitate weighed 500mg, encircle the correct statement:

a) The relative error due to solubility loss is -0.02%.
b) The relative error due to solubility is +2.0%
c) An increase in replicate measurements should increase accuracy
d) An increase in replicate measurements should decrease precision.
e) None of the statements above is correct.

8. The result of the calculation [log 7.230 x 10^9] is reported as 9.8591

a) 9.86 b) 9.8591 c) 9.859 d) 9.85910 e) 9.859100

$s = \sqrt{\frac{(x-\bar{x})^2}{N-1}}$ 21.7.2675 .06767, .05299, .0009 = .1214/3 = $\sqrt{.04}$ = .201

$\bar{x}$ = 7.24 ~~21.72~~

9. A chemist obtained the following data for percent endosulfan in a triplicate analysis of an insecticide preparation: 6.98, 7.47, and 7.27 %. Calculate the 95% confidence limits for the mean of the three data points, assumming that no further information is given about the precision of the method.

$a = \bar{x} \pm \frac{.201 \cdot 4.3}{\sqrt{N}}$

a) 7.24 ± 0.41 b) 7.24± 0.54 c) 7.24± 0.61 d) 7.24 ± 0.83 e) 7.24 ± 0.73

.8643 / 1.414 = .61

10. How many replicate measurements are needed to decrease the 95% confidence intervals for the analysis of iron with the confidence interval of 18.5 ± 3.3μg Fe/ml to ± 1.5 μg Fe/ml. Given that the population standard deviation for the method σ = 2.4.

$\sqrt{N}$ 1.5 = 2.4 * 1.96

a) 6 b) 10 c) 8 d) 9 e) 7

11. The following results were obtained for the determination of Phosphorous in blood serum: 4.40, 4.42, 4.60, 4.48, and 4.50 ppm. Which of the data points should be rejected at 95% confidence.

~~4.5 7 4.67~~ 4.6 7 4.5 7 4.48 7 4.42 7 4.4

a) 4.60 b) 4.40 c) 4.50 d) 4.48 e) all values must be retained

.1/.2

.710

12. Calculate the thermodynemic solubility product constant for $Th(OH)_4$, where the molar solubility of its saturated solution is 3.3 $\times 10^{-4}$ M

a) 3.89×10^{-18} b) 6.88×10^{-17} c) 1.18×10^{-14} d) 1.00×10^{-15} e) $1.18 \times 10^{-1?}$

$Th(OH)_4 = Th + 4OH^-$
x 4x

$Ksp = [x][4x]^4$

256

$Kb = 7.352 \times 10^{-12}$

$[OH^-] = \sqrt{7.352 \times 10^{-12} \times .1}$ 3

$= 8.57 \times 10^{-7}$

13. What is the hydronium ion concentration in 0.100 M sodium chlorate ($ClCH_2COO^-Na^+$) given that $K_a = 1.36 \times 10^{-3}$

a) 1.17×10^{-8} M b) 4.30×10^{-7} M c) 5.15×10^{-6} M d) 8.57×10^{-7} M e) 3.51×10^{-8} M

14. What weight of sodium formate (molar mass 68.0g/mol) must be added to 400.00 ml of 1.00 M formic acid to produce a buffer solution that has a pH of 3.5. Given that K_a for formic acid = 1.8×10^{-4}

a) 10.5 g b) 196.9 g c) 38.7 g d) 27.2 g e) 15.5 g

15. Use activities to calculate the molar solubility of $La(IO_3)_3$ in 0.05M NaCl Given that K_{sp} $La(IO_3)_3 = 1.1\times10^{-11}$

a) 1.6×10^{-2} b) 1.5×10^{-4} M c) 7.4×10^{-5} d) 1.3×10^{-3} e) 7.6×10^{-4}

$\frac{1}{2}[\ ] z^2$

$\frac{1}{2}([.05](1) + .05(1))$

$HCOOH$

$Ksp = La + 3IO_3$

$Ksp = X \quad 3X$

$NaCl \rightarrow Na^+ + Cl$

.05 .05 .05

.05

$La\ \gamma = .24$

$IO_3\ \gamma = .81$

$ksp = \gamma[x]\ \gamma^3[3x]^3$

$1.1\times10^{-11} = .24X \times (.81)^3 (3x^3)$

$.24 \times .5314$

$\frac{1.1\times10^{-11}}{.12754584} = 27x^4$

3.1942

$\cancel{9.586\times10^{-12}} = x^4$

$3.096\times10^{-6} = x^2$

1.75×10^{-3}

$pH = pKa + \log\frac{[A^-]}{[HA]}$

$3.5 = 3.74 + \log\frac{[A^-]}{1}$

$3.77-$

$-.24 = \log[A^-]$

$.58 = [A^-]$

$.58 = \frac{moles}{.4}$

End

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

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

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

Critical 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

B.S.S

11/19

تحليل آلي

17.4/30

تحليل آلي

Analytical Chemistry
First Exam
Second Semester 2008/2009

Date: 25/3/2009 Time: **1 hour**

Name: [redacted] Registration Number: 0075639

Section: lecture days Sun, Tuse, Wen lecture time 8-9

Lecturer: ALAWI TUTUNJI

1.	A	B	C	D	E	11.	A	B	C	D	E
2.	A	B	C	D	E	12.	A	B	C	D	E
3.	A	B	C	D	E	13.	A	B	C	D	E
4.	A	B	C	D	E	14.	A	B	C	D	E
5.	A	B	C	D	E	15.	A	B	C	D	E
6.	A	B	C	D	E	16.	A	B	C	D	E
7.	A	B	C	D	E	17.	A	B	C	D	E
8.	A	B	C	D	E	18.	A	B	C	D	E
9.	A	B	C	D	E	19.	A	B	C	D	E
10.	A	B	C	D	E	20.	A	B	C	D	E

نفس الجواب

GOOD LUCK

Questions 1-4

A solution was prepared by dissolving **605 mg** of $K_3Fe(CN)_6$ (329.2 $gmol^{-1}$) in sufficient water to give a final volume 775ml. Answer questions **1 to 4.** (AW for K = 39.1 g/mol)

Q1 Calculate the analytical molar concentration of $K_3Fe(CN)_6$.

(A) $2.37X10^{-3}$ M (B) $9.84X10^{-2}$ M (C) $1.28X10^{-1}$M
(D) $3.12X10^{-5}$M (E) $5.02X10^{-4}$M

Q2 Calculate the equilibrium molar concentration of K^+.

(A) $3.89X10^{-3}$M (B) $5.63X10^{-3}$M (C) $9.83X10^{-2}$M

(D) $8.98x10^{-3}$M (E) $7.11X10^{-3}$M

Q3 Calculate the number of millimoles of K^+ in 100.0 ml of the above solution.

(A) 0.105 mmol (B) 0.237 mmol (C) 327 mmol

(D) 0.711 mmol (E) 0.711 mmol

Q4 How many ppm of $Fe(CN)_6^{3-}$ (211.58 $gmol^{-1}$) are there in the above solution.

(A) 955.34 (B) 305.12 (C) 211.58
(D) 1050.12 (E) 502.2

Questions 5-7

A 5.89 % (w/w) $Fe(NO_3)_3$ **(241.86 $gmol^{-1}$)** solution has a density of 1.059 gml^{-1}. Answer questions **5 to 7.**

Q5 The analytical molar concentration of $Fe(NO_3)_3$ is:

(A) 0.303M (B) 0.258M (C) 0.774
(D) 1.203 (E) 0.0940

Q6 The PNO_3^- is

-log[.258 M]

(A) 3.18 (B) 0.981 [redacted] 1.21
(D) 2.38 (E) 0.111

$PNO_3^- = -\log[NO_3^-]$

V = .094

Q7 Calculate the volume (ml) of $Fe(NO_3)_3$ solution to prepare a 500.0ml that is 0.9682×10^{-2}M in NO_3^-.

(A) 6.254 ml (B) 3.125 ml (C) 78.5ml
(D) 63.1ml (E) 77.38ml

Q8 What mass of solid $PbCl_2$ **(278.0 gmol⁻¹)** is formed when 150ml of 0.125M Pb^{2+} are mixed with 400ml of 0.175M Cl^- .

(A) 4.86g (B) 9.73g (C) 5.213g
(D) 2.61g (E) 1.68g

Questions 9 - 11

A hydrochloric acid solution was standardized by titration with TRIS. The results of the titrations gave concentrations of **0.1522 M, 0.1526 M, 0.1614 M, and 0.1607M.**

Q9 Can any of the points be rejected at the 95% confidence interval? If so, which one(s)?

(A) 0.1522M (B) 0.1526M (C) 0.1614M
(D) 0.1607M (E) None of the above

Q10 For all the points above, calculate the relative standard deviation in ppt.

(A) 62.64 (B) 31.91 (C) 71.31
(D) 0.157 (E) 2.205×10^{-3}

Q11 For all the points above calculate the confidence interval for μ at the 95% confidence level.

(A) 0.157±6.52 (B) 0.0156 (C) 3.25×10^{-3}

(D) $0.157\pm6.95\times10^{-3}$ (E) $0.157\pm6.86\times10^{-4}$

Q12 What is the density of 54.3 wt % aqueous NaOH (MW = 40.00) if 17.6ml of the solution diluted to 2.00L gives 0.196 M NaOH?

(A) 1.64 g/ml (B) 3.92g/ml (C) 1.32g/ml

(D) 2.88g/ml (E) 0.62g/ml

Q13 Calculate the pH of a **0.0090 M** solution of the weak acid HA with a $K_a = 1.00\times10^{-4}$.

(A) 3.02 (B) 10.98 (C) 6.04

(D) 1.32 (E) 4.68

Q14 Calculate the pH of **0.0850 M** pyridinium bromide, $C_5H_5NH^+Br^-$, with a $K_a = 7.05\times10^{-4}$.

(A) 8.04 (B) 5.62 (C) 3.15

(D) 4.68 (E) 10.85

Q15 A 0.100M solution of the weak acid HA has a pH of 2.36. Calculate pKa for HA.

(A) 2.1 (B) 3.7 (C) 1.3

(D) 4.6 (E) 5.8

Q16 Calculate the pH of a 0.05M solution of the weak base with K_b=1.00X10^{-4}.

(A) 10.21 (B) 7.69 (C) 11.35

(D) 9.68 (E) 8.52

Q17 Calculate the solubility product constant of $Pb(IO_3)_2$ given that the molar concentration of its saturated solution is 1.42 X 10^{-4}M.

(A) 1.3 X 10^{-9} (B) 5.6 X 10^{-14} (C) 2.86 X 10^{-12}

(D) 2.3 X 10^{-11} (E) 3.2 X 10^{-13}

Q18 Encircle the wrong statement:

(A) Water is an amphiprotic solvent

(B) OCl^- is the conjugate base of HOCl

(C) The conjugate acid of a Bronsted-Lowry base is the species formed when an acid accepts a proton

(D) Autoprotolysis of a solvent produces both a conjugate acid and a conjugate base

(E) Solutions of a salt like NH_4Cl are acidic

For questions **19 to 20** calculate the answer and the appropriate uncertainty for each of the following results:

Q19 15.8 (±0.6) + 7.3 (±0.3) – 23.1 (±0.4) =

(A) 1.3 (±0.1) (B) 2.1 (±0.2) (C) 0.0 (±0.8)

(D) 0.01 (±0.05) (E) 0.0 (±0.5)

Q20 $\frac{44.4(\pm 0.5)}{3.18(\pm 0.02) X 10^{4}} =$

(A) 1.44 (±0.3) X 10^{-2} (B) 44.4 (±0.5) X 10^{3} (C) 1.40 (±0.1) X 10^{4}

(D) 1.40 (±0.02) X 10^{-3} (E) 4.44 (±0.02) X 10^{3}

CRITICAL VALUES FOR REJECTION QUOTIENT Q			
Number of Observations			
	90% Confidence	95% Confidence	99% Confidence
3	0.94	0.98	0.99
4	0.76	0.85	0.93
5	0.64	0.73	0.82
6	0.56	0.64	0.74
7	0.51	0.59	0.68
8	0.47	0.54	0.63

CONFIDENCE LEVELS FOR VARIOUS VALUES OF Z	
CONFIDENCE LEVEL, %	Z
50	0.67
68	1.00
80	1.29
90	1.64
95	1.96
96	2.00
99	2.58
99.7	3.00

Values of t for Various Levels of Probability				
Degree of Freedom	Factor for Confidence Interval			
	80%	90%	95%	99%
1	3.08	6.31	12.7	63.7
2	1.89	2.92	4.30	9.92
3	1.64	2.35	3.18	5.84
4	1.53	2.13	2.78	4.60
5	1.48	2.02	2.57	4.03
6	1.44	1.94	2.45	3.71

جمعية العلوم الحياتية
B.S.S

تحليل آلي

Analytical Chemistry
Second Exam
Second Semester 2008/2009

Date: 10/5/2009 Time: **1 hour 15 minutes**

Name: [redacted] Registration Number: 0075639

Section: lecture days ______ lecture time: (A-4)

Lecturer: ALAWI TUTUNJI

1.	A	B	C	D	E	10.	A	B	C	D	E
2.	A	B	C	D	E	11.	A	B	C	D	E
3.	A	B	C	D	E	12.	A	B	C	D	E
4.	A	B	C	D	E	13.	A	B	C	D	E
5.	A	B	C	D	E	14.	A	B	C	D	E
6.	A	B	C	D	E	15.	A	B	C	D	E
7.	A	B	C	D	E	16.	A	B	C	D	E
8.	A	B	C	D	E	17.	A	B	C	D	E
9.	A	B	C	D	E	18.	A	B	C	D	E

Good Luck

اتحاد طلبة العلوم الحياتية 2012

عشيرة دحلة كمل

$pH = pKa + \log \frac{[CH_3NH_2]}{[CH_3NH_3]}$

$1 : 359$

Q1 Calculate the ratio $[CH_3NH_2]/[CH_3NH_3^+]$ in a methylamine solution that has been buffered to pH= 4.00 given that Ka = 2.29×10^{-11}

(a) 2.3×10^{-7} (b) 1.00 (c) 23.12

(d) 8.5×10^{-5} (e) None of the above

Q2 A 2.4414g sample containing KCl, K_2SO_4 and inert material was dissolved in sufficient water to give 250ml of solution. A Mohr titration of a 50.00 ml aliquot required 41.36 ml of

.05818 0.[illegible]M $AgNO_3$. A second 50.0ml aliquot was treated with 40.00 ml of 0.1083M $NaB(C_6H_5)_4$. The reaction is:

$$NaB(C_6H_5)_4 + K^+ \rightarrow KB(C_6H_5)_4 + Na^+$$

The solid was filtered, redissolved in acetone, and titrated with 49.98ml of $AgNO_3$ solution. Calculate the percentage of KCl and K_2SO_4 in the sample.

(a) % KCl 36.73, % K_2SO_4 8.95 (b) % KCl 45.24, % K_2SO_4 13.29

(c) % KCl 15.24, % K_2SO_4 42.81 (d) % KCl 30.62, % K_2SO_4 41.26

(e) % KCl 41.62, % K_2SO_4 17.28

Questions 3 to 6

Calculate the silver ion concentration after the addition of the following volumes (ml) of 0.0500M $AgNO_3$ to 50.0ml of 0.0400 M KBr given that the Ksp for AgBr = 5.0×10^{-13}.

Q3 Calculate the $[Ag^+]$ at zero volume of $AgNO_3$ added.

(a) $[Ag^+] = 0.0500M$ (b) $2 \times 10^{-5}M$ (c) 5.00×10^{-13} (d) 0.0400M

(e) $pAg^+ = \infty$

$AgNO_3 = [.05]$

add KBr $V = 50.0\,mL$; $[.04]$

$K_{sp} = 5.0 \times 10^{-13}$

$AgNO_3 + KBr \rightleftharpoons AgBr + KNO_3$

.05 .04 M, 50. mL = 2×10^{-3} mol

.05 M $AgNO_3$

Q4 Calculate the pAg^+ after the addition of 5.00ml of the silver ion.

(a) 1.6×10^{-11} M (b) 3.51 (c) 8.96 (d) 10.80 (e) 12.80

$[Ag^+] = \frac{K_{sp} \cdot V_{tot}}{n_{X^-} - n_{Ag}} = \frac{5\times10^{-13} \times (.05+.05)}{2\times10^{-3} - 2.5\times10^{-4}} = \frac{2.75\times10^{-14}}{1.75\times10^{-3}} = 1.57\times10$

Q5 Calculate the silver ion concentration after the addition of 40.00ml of $AgNO_3$.

(a) 3.5×10^{-3} M (b) 7.1×10^{-7} (c) $pAg^+ = 9.8$ (d) 1.6×10^{-5} M

(e) 1.6×10^{-2}M

$4.5\times10^{-14} = \frac{5\times10^{-13} \times (.04+.05)}{2\times10^{-3} - 2\times10^{-3}}$

$= \frac{K_{sp} \cdot V_{tot}}{n_{X^-} - n_{Ag}} = \frac{5\times10^{-13}\times .09}{2-2}$

Q6 Calculate the pAg^+ after the addition of 50.00ml of $AgNO_3$.

(a) 2.30 (b) 6.15 (c) 9.86 (d) 5.46 (e) 4.39

$n = \frac{m}{M_m}$

30.97

Q7 The digestion of a 0.1432g sample of a compound containing phosphorous in a mixture of HNO_3 and H_2SO_4 resulted in the formation of CO_2, H_2O, and H_3PO_4. Addition of ammonium molybdate yielded a solid having a composition $(NH_4)_3PO_4.12MoO_3$ (MW = 1876.3 g/mol). This precipitate was filtered, washed, and dissolved in 50.00ml of 0.2000 M NaOH: n_{NaOH} total

$$(NH_4)_3PO_4.12MoO_3 + 26\ OH^- \longrightarrow HPO_4^{2-} + 12\ MoO_4^{2-} + 14\ H_2O + 3NH_3\ (g)$$

The solution was then boiled to remove the NH_3 the excess NaOH was titrated with 14.71 ml of 0.1741M HCl to a phenolphthalein end point. Calculate the percentage of phosphorous in the sample.

.01471

$n_{HCl} = n_{NaOH}$

$NaOH + HCl \rightarrow NaCl + H_2O$

(a) 62.86% (b) 6.19% (c) 26.68% (d) 9.16% (e) 6.91%

$\boxed{n \text{ HCl} = 2.56\times10^{-3}}$

$\% = \frac{\text{mass } P}{.1432 g} \times 100$

NaOH 26 mol 2.56×10^{-3} $\Rightarrow$ mol 9.85×10^{-5}

NaOH 26 mol HPO4 1 mol

2.56×10^{-3}

$\Rightarrow HPO_4 = 10.15\times10^{-3}$ mol

HPO4 1 mol P 1 mol

$\Rightarrow mol = 10.15\times10^{-3} =$

Q8 Encircle the correct statement:

(a) For colloidal precipitates, analysts should initially dilute the test solution to cause coagulation

(b) Analysts should perform a digestion step during precipitation to decrease the size of the 1^{o} and 2^{o} adsorption layers.

(c) Digestion and peptization are important to obtain cleaner precipitates ✗

(d) Crystalline precipitates can never be contaminated by surface adsorption ✓

(e) Mixed crystal formation may be reduced by digestion $FeCO_3 \rightleftharpoons Fe^{+2} + CO_3^{-2}$

$K_{sp} = [Fe][CO_3]$

Questions 9-13

$2H_2O \rightleftharpoons H^+ + OH^- \rightarrow K_w = [H^+][OH^-]$

Consider the dissociation of iron (II) carbonate ($FeCO_3$; $K_{sp} = 2.1 \times 10^{-11}$).

Q9 Calculate the molar solubility of $FeCO_3$ in water (Hint – assume $\gamma_i = 1$ for all ions in this situation).

(a) 8×10^{-5} (b) 7.1×10^{-4} (c) 1.1×10^{-2} (d) 5.2×10^{-8}

(e) 4.6×10^{-6}

$FeCO_3 \rightleftharpoons Fe^{+2} + CO_3^{-2}$ $NaCl \rightleftharpoons Na^+ + Cl^-$

$K_{sp} = [Fe]\gamma_{Fe} \cdot [CO_3^{2-}]\gamma_{CO_3}$

Q10 Calculate the concentration solubility product constant for $FeCO_3$ in 0.0010 M NaCl.

(a) 2.8×10^{-11} (b) 3.2×10^{-9} (c) 5.1×10^{-7} (d) 5.2×10^{-8}

(e) 6.5×10^{-4}

$K_{sp}' = \frac{K_{sp}}{\gamma_{Fe} \cdot \gamma_{CO_3}}$

$\frac{2.1 \times 10^{-11}}{.87 \times .868} = [x]^2$

Q11 Calculate the molar solubility of $FeCO_3$ in 0.0010M NaCl.

(a) 1.3×10^{-4} M (b) 3.2×10^{-9} M (c) 5.3×10^{-6} M

(d) 9.5×10^{-9} M (e) 4.5×10^{-7} M

$FeCO_3 \rightleftharpoons Fe + CO_3$ $NaCl \rightleftharpoons Na^+ + Cl^-$

$K_{sp} = [X][X]$

2.1×10^{-11}

$K_{sp} = 2.1 \times 10^{-11}$

Q12 Calculate the molar solubility of $FeCO_3$ in a solution of 0.167 M Na_2CO_3.

(a) 4.8×10^{-6}M (b) 2.3×10^{-8}M (c) 5.3×10^{-6}M (d) 3.9×10^{-5}M

(e) 1.26×10^{-10}M

$FeCO_3 \rightleftharpoons Fe + CO_3$
$x \quad (x+.167)$

$Na_2CO_3 \rightleftharpoons 2Na^{+1} + CO_3^{-1}$
$(2 \times .167) \quad (.167)$

$K_{sp} = [x][x+.167]$
$\Longrightarrow x = 2.1$

Q13 Calculate the percent relative error associated with the assumption that the activity would equal the concentration for question 11.

(a) -10% (b) +5% (c) -13.2% (d) – 8.2 % (e) 3.6 %

Q14 Write the charge balance equation for aqueous sodium carbonate (Na_2CO_3). Carbonate reacts as follows: $CO_3^{2-} + H_2O(l) \rightarrow HCO_3^- + OH^-$

$HCO_3^- + H_2O(l) \rightarrow H_2CO_3 + OH^-$

$[Na^+] + [H^+] = [OH^-] + 2[CO_3] + [HCO_3]$

(a) $[Na^+] = [OH^-] + [HCO_3^-] + 2[CO_3^{2-}]$

(b) $[Na^+] = [H_2CO_3] + [HCO_3^-] + [CO_3^{2-}]$

(c) $[H^+] + [Na^+] = [OH^-] + [HCO_3^-] + 2[CO_3^{2-}]$

(d) $2[CO_3^{2-}] + [OH^-] = [Na^+] + [H_3O^+]$

(e) None of the above

$I\uparrow$

Q15 As ionic strength increases, the values of the activity coefficients:

(a) Change randomly (b) increase (c) decrease (d) do not change

(e) None of the above

Q16 Encircle the correct statement(s):

(a) Inclusion of mixed-crystal formation is a type of co-precipitation in which contaminant ion is trapped in the crystalline space.

(b) A 2° adsorption layer describes a layer of solution surrounding a charged particle that contains excess of charged ions.

(c) Peptization is a process by which a coagulated colloid returns to its original dispersed state as a consequence of decreased electrolyte concentration.

(d) Peptization can be avoided by washing the coagulated colloid with a large volume of water

(e) Digestion is a process in which a precipitate is cooled in the presence of the solution from which it was formed

Q17 What is the mass balance for the following chemical equations?

$$NiCO_{3(s)} \rightarrow Ni^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)}$$

$$CO_3^{2-}{}_{(aq)} + H_2O_{(l)} \leftrightarrow HCO_{3(aq)} + OH^-_{(aq)}$$

$$HCO_3^-{}_{(aq)} + H_2O_{(l)} \leftrightarrow H_2CO_{3(aq)} + OH^-_{(aq)}$$

$$H_2O_{(l)} \leftrightarrow OH^-_{(aq)} + H^+_{(aq)}$$

(a) $[Ni^{2+}]^2 + [H^+] = [CO_3^{2-}]^2 + [HCO_3^-] + [OH^-]$

(b) $[Ni^{2+}] = [CO_3^{2-}] + [HCO_3^-] + [H_2CO_3]$

(c) $2\,[Ni^{2+}] = 2[H^+] + 2[CO_3^{2-}] + [HCO_3^-] + [H_2CO_3] + [OH^-]$

(e) $2[Ni^{2+}] = 2[CO_3^{2-}] + [HCO_3^-] + [H_2CO_3]$

Q18 Encircle the correct statement

(a) Gravimetric analysis is more accurate than volumetric analysis because the analytical signal is mass of a precipitate

(b) The primary standard is necessary to standardize another primary standard

(c) In volumetric analysis the interferences are similar to those of gravimetric analysis

(d) One can choose a common indicator for all volumetric titrations

(e) Equivalence points always occur before endpoints in volumetric analysis

University of Jordan
Department of Chemistry
Analytical Chemistry 211
May 10, 09 *Time: 75 min*

Student's Name: ______________________________

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^-, $H_2PO_4^-$, $H_2AsO_4^-$, 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	0.75
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	0.596	0.305	0.200	0.047	0.020

Source: J. Kielland, J. Am. Chem. Soc., 1937, 59, 1675. Courtesy of the American Cheical Society.

$Fe^{+2} = .870$

$CO_3^{-2} = .868$

PERIODIC TABLE OF THE ELEMENTS

A	IIA	IIIB	IVB	VB	VIB	VIIB	VIII	VIII	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	O
1 H 079																	2 He 4.0026
3 Li ,941	4 Be 9.0122											5 B 10.81	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.179
11 Na 9898	12 Mg 24.305											13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.06	17 Cl 35.453	18 Ar 39.948
19 K .098	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.90	23 V 50.9414	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.916	36 Kr 83.80
37 Rb .4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.22	41 Nb 92.9064	42 Mo 95.94	43 Tc 98.7062	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.4	47 Ag 107.868	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30
55 Cs 2.9054	56 Ba 137.34	57 *La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.22	78 Pt 195.09	79 Au 196.9665	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0254	89 †Ac (227)															

*LANTHANIDE SERIES

58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (147)	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.97
90 Th 232.0381	91 Pa 231.0359	92 U 238.029	93 Np 237.0482	94 Pu (244)	95 Am (243)	96 Cm (245)	97 Bk (247)	98 Cf (249)	99 Es (249)	100 Fm (255)	101 Md (256)	102 No (254)	103 Lr (257)

17

16/26

+1

25.5

~~24~~/30

Analytical Chemistry
Department of Chemistry
Analytical Chemistry 211
Midterm Exam

Date:13/11/2010
Time: 75 minutes

Student Name: ابراهيم "محمد طاهر" علي القبيسي

Registration No.: 00900075

Section: 2:00 – 3:00 ح ث خ

ANSWER SHEET

1.	a	~~b~~	c	d	e	11.	a	b	c	d	~~e~~
2.	~~a~~	b	c	~~d~~	e	12.	a	b	~~c~~	d	e
3.	a	b	c	d	~~e~~	13.	a	b	c	d	~~e~~
4.	a	b	~~c~~	d	e	14.	a	b	c	~~d~~	e
5.	a	~~b~~	c	d	e	15.	a	b	c	d	~~e~~
6.	a	b	~~c~~	d	e	16.	~~a~~	b	c	d	e
7.	a	b	c	~~d~~	e	17.	a	~~b~~	c	d	e
8.	a	~~b~~	c	d	e	18.	~~a~~	b	c	d	e
9.	a	b	~~c~~	d	e	19.	~~a~~	b	c	d	e
10.	~~a~~	b	c	d	e	20.	a	b	c	~~d~~	e

GOOD LUCK

$D = \frac{m}{v}$

$\rightarrow v = \frac{m}{D}$

$M = \frac{d \times \% \times 10}{MM}$

1. Calculate the density of 54.3(wt/wt %) aqueous NaOH (molar mass = 40.00 g /mole) if you know that this solution is 19.2M.

a) 2.96 g ml^{-1} b) 1.41 g ml^{-1} c) 2.83 g ml^{-1}
d) 1.46 g ml^{-1} e) 1.52 g ml^{-1}

1.08 g

mol = 0.0469

$mol = \frac{1.08}{23} = 0.0469$

$v = \frac{10^3}{1.06}$

2. Brine water contains an average of 1.08×10^3 ppm of Na^+ (molar mass 23 g /mol), given that the density of the brine is 1.06 g/mL, Calculate the species (equilibrium) molar concentration of Na^+:

$M = \frac{n}{v}$

a) 0.0500 M b) 0.0369 M c) 0.0925 M d) 1.01 M
e) 0.0759 M

$M = \frac{mol}{v} = \frac{0.0469}{\frac{10^3}{1.06}}$

3. Calculate the pOH in a solution that is 6.20×10^{-3} M $Ba(OH)_2$ and 2.31×10^{-2} M in NaOH:

a) 2.671 b) 2.400 c) 1.123 d) 3.619 e) 1.450

4. A solution was prepared by dissolving 7.56 g of $KCl.MgCl_2.6H_2O$ (molar mass = 277.85 g/mol) in sufficient water to give 3.00 L solution. Calculate:

the molar analytical concentration of $KCl.MgCl_2$ in this solution.

a) 1.06×10^{-6} M b) 3.2×10^{-5} M c) 9.07×10^{-3} M
d) 2.77×10^{-2} M e) 1.32×10^{-4} M

$Mg^{+2} + 2Cl^-$

5. For question no. 4 above calculate the ppm of Mg^{2+} (molar mass = 24.3 g/mol).

$= \frac{m}{V}$

a) 150.1 b) 220.4 c) 20.9 d) 304.1 e) 73.5

Na Hg

2 3

0.0113 [16.9]

51.51 - 16.9 = 34.6 / 130 = b

6. When a 30.0 mL of 0.3757 M solution of Na_3PO_4 were mixed with 100.0 mL of 0.5151 M $Hg(NO_3)_2$, calculate the molarity of the unreacted species (Na_3PO_4 or $Hg(NO_3)_2$) after the reaction was complete:

$2PO4^{2-} + 3\,Hg^{2+} \rightarrow Hg_3\,(PO_4)_2$

Mol = 11.2 = 5.6 Mol

a) 0.0917M b) 0.266 M c) 0.118 M

d) 3.20×10^{-2} M e) 8.23×10^{-5} M

Mol = 51.51 = 17.17

7. The correct statement among the following is:

a) Proportional errors have the same magnitude regardless of sample size.
b) All analytical measurements have determinate errors.
c) Random errors are evaluated by the closeness of measured values to the true value.
d) Constant errors should have the same magnitude regardless of the sample size
e) Determinate errors are mathematically expressed by the CV(%).

8. Suppose that 0.1 mg of a precipitate was lost as a result of being washed with 300 mL of wash liquid. If the precipitate weighed 500mg, encircle the correct statement:

a) The relative error due to solubility loss is +2.0%.
b) The above information should lead to a conclusion regarding relative precision.
c) An increase in replicate measurements should increase precision.
d) An increase in replicate measurements should increase accuracy.
e) None of the statements above are correct.

9. The result of the calculation [log 7.230×10^9] is reported as

a) 9.86 b) 9.859 c) 9.8591 d) 9.85910 e) 9.859100

10. Consider the following mathematical operation

$$\frac{157(\pm 6) - 59(\pm 3)}{1220(\pm 1) + 77(\pm 8)} = 0.075559$$

98 ± 6.708
1297 ± 8.0623

2

Upon calculation of the standard deviation, the result of the calculation is reported as

a) 0.076 (± 0.005) b) 0.09 (± 0.01) c) 0.0757 (± 0.0002)
d) 0.07573 (± 0.00008) e) 0.1 (± 0.1)

11. The following results were obtained in the replicate determination of the lead content of a blood sample: 0.752, 0.756, 0.752, 0.751 and 0.756 ppm Pb. Given that s= 0,004 Pb, calculate the standard error of the mean. $\bar{x}$ = 0.7534

a) 0.004 b) 0.008 c) 0.002 d) 0.1 e) 1 5

12. Analysis of two samples for their potassium content yielded the following data:

Sample	No. of replicate results	Percent potassium
1	4	5.15, 5.03, 5.04, 5.85
2	3	7.18, 7.17, 6.97

$\bar{x}$ = 5.2675
$\bar{x}$ = 7.106

7-2 sum(1) = 0.461
sum(2) = 0.0280

The pooled standard deviation, S_{pooled} for these data is

a) 0.74 b) 0.15 c) 0.31 d) 0.082 e) 0.96

$CV = \frac{S}{\bar{x}} \times 100\%$

13. Consider the following set of data $\bar{x} = 0.4984$
0.514, 0.503, 0.486, 0.497, and 0.492. Given that the standard deviation, s=0.011. Calculate the coefficient of variation for this set of data

$S = \frac{\quad}{n-1}$

$\frac{S}{\bar{x}} \times 100\% = \frac{0.011}{0.4984}$

a) 0.15% b) 11% c) 7.1% d) 13% e) 2.2%

14. The following measurements for dissolved oxygen in a river water are 4.90, 5.10, 5.60, 4.30, 4.70, 4.90, 4.50 and 5.10. Given that a pooled estimate the standard deviation, $S_{pooled} \rightarrow \sigma = 0.40$, calculate the 90% confidence limits for these data

CI

$\bar{x} = 4.8$

a) 4.90 ± 0.72 b) 4.90 ± 0.11 c) 4.90 ± 0.56
d) 4.90 ± 0.23 e) 4.90 ± 0.09

$CI = \bar{x} \pm \frac{ts}{\sqrt{n}}$

$= 4.9 \pm \frac{0.4 \times}{\sqrt{8}}$

15. The following data for mercury levels in a sample of polluted water were obtained. 1.00, 2.50, 3.00, 3.50, 4.00, 4.25, 4.50, 4.75, 6.75 ppm. The result that should be rejected at the 90% confidence level is

رفض

a) 1.00 ppm b) 2.50 c) 6.75 d) 4.00 e) none

-(0.437) للمقارنة

Q tei -

16. The confidence interval increases with $CV = \frac{S}{\bar{x}} \times 100\%$

a) increasing standard deviation
b) increasing number of results or measurements
c) increasing number of degrees of freedom
d) decreasing confidence level
e) all the above

$CI = \bar{x} \pm \frac{ts}{\sqrt{n}}$

اعلى قيمة

$\frac{Q_{test} - Q_{criti}}{Q_{Lost}}$

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

Ksp

M

17. Calculate the solubility of PbI_2 in a solution that is 0.010M NaI.
K_{sp} for PbI_2 is 1.0×10^{-17}.

Na + I

a) 1.0×10^{-16} M b) 1.0×10^{-13} M c) 1.0×10^{-15} M
d) 1.6×10^{-6} M e) 6.1×10^{-6} M

18. What is the hydroxide ion concentration of a 0.150 M NH_3 solution?
K_b for $NH_3 = 1.8 \times 10^{-5}$

$NH_3 + H_2O \rightleftharpoons OH + NH_4$

a) 1.64×10^{-3} M b) 6.17×10^{-12} M c) 1.15×10^{-3} M
d) 8.70×10^{-12} M e) None of the above

added

19. Calculate the pH change that takes place when a 100 mL portion of
0.0500 M NaOH is added to 400 mL of a buffer solution that consists of
0.200 M HAc and 0.300 M NaAc?
K_a for HAc: 1.8×10^{-5}

$HAc + H_2O \rightleftharpoons Ac + H_3O$

0.195 0.305

0.523 HA A

$K_a = \frac{[Ac][H_3O]}{[HAc]}$

a) $\Delta pH = +0.05$ b) $\Delta pH = -0.05$ c) $\Delta pH = +0.01$
d) $\Delta pH = -0.09$ e) $\Delta pH = -0.01$

$pH = pKa + \log \frac{[Ac]}{[HAc]}$

$= 4.938$

Mw

20. What weight of sodium formate (molar mass=68.0 g/ mol) must be
added to 400.0 mL of 1.00 M formic acid to produce a buffer solution
that has a pH of 3.50?
K_a for HCOOH = 1.8×10^{-4}
(assume that addition of solid sodium formate does not change the volume
of the solution)

a) 19.5 g b) 23.0 g c) 14.5 g d) 15.5 g e) 1.95 g

$pH = pKa + \log \frac{[A^-]}{[M]}$

$1.8 \times 10^{-4} = \frac{[x]\ 3.16 \times 10^{-4}}{1.00}$ 0.57

$[x] = 0.569$

10

Table 7-2

Values of t for Various Levels of Probability

Degrees of Freedom	Factor for Confidence Interval 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	8.60
5	1.48	2.02	2.57	4.03	6.86
6	1.44	1.94	2.45	3.71	5.96
7	1.42	1.90	2.36	3.50	5.40
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
11	1.36	1.80	2.20	3.11	4.44
12	1.36	1.78	2.18	3.06	4.32
13	1.35	1.77	2.16	3.01	4.22
14	1.34	1.76	2.14	2.98	4.14
∞	1.29	1.64	1.96	2.58	3.29

Table 9-1

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

Source: J. Kielland, *J. Am. Chem. Soc.*, 1937, *59*, 1675. Courtesy of the American Chemical Society.

Number of Observations	Q_{crit} (Reject if $Q_{exp} > Q_{crit}$) 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 Levels, %	z
50	0.67
68	1.00
80	1.29
90	1.64
95	1.96
95.4	2.00
99	2.58
99.7	3.00
99.9	3.29