practical Analytical chemistry

*Name: Renad abed alhakim alKawarah.

*Reg.No: 0201324

*Locker No.: 307

*section: 9

8/10

*Instructor: Mohammad Amer

*Date: 9-3-2022

*experiment: exp 1, Volumetric glassware and Balances.

Experiment 1

Data sheet and calculations

Name:
Reg. No.:

Section:
Date:

	Trial (1)	Trial (2)	Trial (3)
Initial burette reading	1.00 ± 0.05	6.00 ± 0.05	11.20 ± 0.05
Final burette reading	6.00 ± 0.05	11.20 ± 0.05	16.00 ± 0.05
Apparent volume, ml	5.00 ± 0.07	5.2 ± 0.07	4.8 ± 0.07
Weight of empty flask	6.6255 ± 0.0001	6.6319 ± 0.0001	6.6417 ± 0.0001
Weight of flask and water	11.7389 ± 0.0001	11.7495 ± 0.0001	11.6851 ± 0.0001
Weight of water, g	5.1134 ± 0.0001	5.1176 ± 0.0001	5.0434 ± 0.0001
Temperature, °C	17.0 ± 0.5	17.0 ± 0.5	17.0 ± 0.5
Actual (experimental) volume, ml	5.1251	5.1293	5.0549
Correction (ml)	0.1251	-0.07	0.2549

Calculate the volume of water contained in each 5 ml portion from the above data

Instructor's Signature: .....

Instructor's Name: ايمان محمد

9/3/2022

* purpose ⇒
weighing on the analytical balance and calibration of Volumetric glassware.

* Main observation of the experiment ⇒
Calibrate certain measurement by using volumetric glassware.

#ref: practical Analytical chemistry.
#ref: bartleby.com

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* calculations ⇒

#Apparent volume, mL :-
* trial 1 ⇒ 6.00 _ 1.00 = 5.00 mL
* trial 2 ⇒ 11.20 - 6.00 = 5.2 mL
* trial 3 ⇒ 16.00 - 11.20 = 4.8 mL

• uncertainty :-
* Balance = ±0.0001 * buret = 1/2 * 0.1 = ±0.05 * Thermometer = 1/2 * 1.0 = ±0.5
* Buret (apparent volume) = $\sqrt{(0.05)^2 + (0.05)^2}$ = ±0.07

#weight of water (g) :-
* trial 1 ⇒ 11.7389 - 6.6255 = 5.1134 g
* trial 2 ⇒ 11.7495 - 6.6319 = 5.1176 g
* trial 3 ⇒ 11.6861 - 6.6417 = 5.0434 g
• uncertainty of the weight of water : $\sqrt{(0.0001)^2 + (0.0001)^2}$ = ±0.0001

Temperture :- 17 C° ± 0.5, (for 1 g at 17C° ⇝ 1.0023 mL) -1

* trial 1 ⇒ 1 g → 1.0023 mL
5.1134 g → ? ⇝ 5.1251 mL (actual Volume)

* trial 2 ⇒ 1 g → 1.0023 mL
5.1176 g → ? ⇝ 5.1293 mL (actual volume)

* trial 3 ⇒ 1 g → 1.0023 mL
5.0434 g → ? ⇝ 5.0549 mL (actual Volume)

Correction :

* trial 1 ⇒ 5.1251 − 5.00 = 0.1251 ml — 0.5
* trial 2 ⇒ 5.1293 − 5.2 = −0.07 ml
* trial 3 ⇒ 5.0549 − 4.8 = 0.2549 ml

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* Conclusions :-

I Learned How to calibrate the glassware & clean the glassware by using a brush the quality of my data was ~~not bad~~ but I think I made some mistakes.

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* Questions :-

1] 1) dispensing liquids Too quickly.
2) cleaning Irregularly or Not at all.
3) using the wrong pipette Tips.

2] correction = actual − apparent ⇒ 10.0356 − 10.00 = 0.0356 ml

3] personal protective equipment (PPE)
1) Laboratory coats.
2) safety glasses.
3) Gloves.
4) fully enclosed footwear.

* Q, P13, in the practical Analytical chemistry :-

1) at 25°C ⇝ 1.0038 ml

1 g → 1.0038 ml ⇝ actual Volume = 25.071 ml
24.976 g → ? (×)

2) at 20°C ⇝ 1.0028 ml

1 g → 1.0028 ml ⇝ actual Volume = 25.046 ml
24.976 g → ? (×)

practical Analytical chemistry

Name: Renad abed al hakim.

9/10

Reg.No: 0201324.

Locker No: 307.

Sec.No: 9.

Instructor: Mohammad Amer.

Date: 16/3/2022.

exp: sampling and statistical Handling Data. (2)

22.2

Experiment 2
Data Sheet and Calculations

Name: Section:

Reg. No.: Date: 2±0.05

0.05

A. Homogenous sample

Result no.	V_S	V_B	V_S-V_B
1	10.9 ±0.07	0.1 ±0.05	10.8 ±0.09
2	11.3 ±0.07	0.1 ±0.05	11.2 ±0.09
3	10.8 ±0.07	0.1 ±0.05	10.7 ±0.09
4	11.2 ±0.07	0.1 ±0.05	11.1 ±0.09
5	11.60 ±0.07	0.1 ±0.05	11.5 ±0.09

B. Non-homogenous sample

Result no.	V_S	V_B	V_S-V_B
1	9.9 ±0.07	0.1 ±0.05	9.8 ±0.09
2	10.1 ±0.07	0.1 ±0.05	10.0 ±0.09
3	12.1 ±0.07	0.1 ±0.05	12.0 ±0.09
4	12.60 ±0.07	0.1 ±0.05	12.5 ±0.09
5	12.80 ±0.07	0.1 ±0.05	12.7 ±0.09

Instructor's Signature: .....

Instructor's Name: .....

16/3/2022 wed

*purpose:-

Simple sampling and appreciates the importance of sampling and its effect on analytical data also practices statical treatment of analytical data.

ref: practical analytical chemistry.

*Main observation of the exp:-

practices statical treatment of analytical data

*calculation:- / $CH_3COOH + NaOH \rightleftharpoons CH_3COONa + H_2O$

Homogenuos ⇒

(1) $V_s - V_B$ →

- trail (1): 10.9 − 0.1 = 10.8
- trail (2): 11.3 − 0.1 = 11.2
- trail (3): 10.8 − 0.1 = 10.7
- trail (4): 11.2 − 0.1 = 11.1
- trail (5): 11.6 − 0.1 = 11.5

*uncertainty →

- $V_s \rightarrow V_f - V_i = \sqrt{(0.05)^2 - (0.05)^2} = 0.07$
- $V_B \rightarrow 0.05 \rightarrow 1/2 + \text{last division} = 1/2 + 0.1 = 0.05$
- $V_s - V_B = \sqrt{(0.05)^2 + (0.07)^2} = 0.09$

(2) Q test → ($Q_{critical} = 0.642$)

⇒ 10.7, 10.8, 11.1, 11.2, 11.5

↳ $Q_{exp} = \frac{|11.2 - 11.5|}{11.5 - 10.7} = 0.375 < Q_{critical}$ → Accepted.

↳ $Q_{exp} = \frac{|10.7 - 10.8|}{11.5 - 10.7} = 0.125 < Q_{critical}$ → Accepted.

(3) mean ($\bar{x}$) → $\frac{1}{n} \Sigma x$ → 11.06

(4) meadian ($\bar{y}$) → 11.1

(5) average deviation from the mean → $\frac{\Sigma |x_i - \bar{x}|}{n} = \frac{1.24}{5} = 0.248$

(6) Relative average deviation from the mean → $\frac{\Sigma |x - \bar{x}|}{n \bar{x}} * 100\% = 2.24\%$

(7) average deviation from the median → $\frac{\Sigma |x - \bar{y}|}{n} = \frac{1.2}{5} = 0.24$

(8) Relative average deviation from the meadian → $\frac{\Sigma |x - \bar{y}|}{n \bar{y}} * 100\% = 2.17\%$

non-Homogenues ⇒

(1) $V_s - V_B$ →

- trail (1): 9.9 − 0.1 = 9.8
- trail (2): 10.1 − 0.1 = 10.0
- trail (3): 12.1 − 0.1 = 12.0
- trail (4): 12.6 − 0.1 = 12.5
- trail (5): 12.8 − 0.1 = 12.7

* uncertanty →

- V_s → $V_s - V_f$ → $\sqrt{(0.05)^2 + (0.05)^2} = 0.07$
- V_B → 0.05 → 1/2 * less devision = 1/2 * 0.1 = 0.05
- $V_s - V_B$ → $\sqrt{(0.07)^2 + (0.05)^2} = 0.09$

(2) Q-test → (Q critical = 0.642)

⇒ 9.8, 10.0, 12.0, 12.5, 12.7

↳ $Q_{exp} = \frac{|12.5 - 12.7|}{12.7 - 9.8} = 0.068 < Q_{critical}$ → accepted

↳ $Q_{exp} = \frac{|9.8 - 10.0|}{12.7 - 9.8} = 0.068 < Q_{critical}$ → accepted

(3) mean ($\bar{x}$) → $\frac{1}{n}\Sigma x$ → 11.4

(4) meadian ($\bar{y}$) → 12.0

(5) average deviation from the mean → $\frac{\Sigma|x_i - \bar{x}|}{n} = \frac{6.0}{5} = \boxed{1.2}$

(6) Relative average deviation from the mean → $\frac{\Sigma|x - \bar{x}|}{n\bar{x}} * 100\% = \boxed{10.52\%}$

(7) average deviation from the meadian → $\frac{\Sigma|x - \bar{y}|}{n\bar{x}} * 100\% = \frac{5.4}{5} = \boxed{1.08}$

(8) relative average deviation from the meadian → $\frac{\Sigma|x - \bar{y}|}{n\bar{y}} * 100\% = \boxed{9.00\%}$

(9) standard deviation → $s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} = \boxed{1.394}$

(10) Relative standard deviation → $\frac{s}{\bar{x}} * 100\% = \boxed{12.23\%}$

* Conclusions →

Homogenous sample can be supply more represented data than non-Homogenous sample

* Questions ⇒ P(4)

1]

groups	Homogenous	non-Homogenous
mean	11.06 <	11.4
S.D	0.3209 <	1.394
R.S.D	2.9% <	12.23%

2] Homogenous →

$MV_{NaOH} = MV_{(CH_3COOH)}$

$(0.1)(11.06) = M(10.0)$

↳ $M_{CH_3COOH} = 0.1106\ M$

non-Homogenous →

$MV_{NaOH} = MV_{CH_3COOH}$

$(0.1)(11.4) = M(10.0)$

↳ $M_{CH_3COOH} = 0.114\ M$

3] Homogenous →

$\frac{X_1 - X_t}{X_t} * 100\%$

↳ $\frac{0.1106 - 0.1}{0.1} * 100\%$

$= 10.6\%$

more accurate and prescise

non Homogenous →

$\frac{X_1 - X_t}{X_t} * 100\%$

↳ $\frac{0.114 - 0.1}{0.1} * 100\%$

$= 14.0\%$

which is more accurate and prescise ??

* Questions ⇒ (elearning)

1] To avoid constant error which effect the process measurement.

2] sampling: to get a represent sample from the all solution.

3] Mean is the average value of set of given data and median is the middle value when the data set is arranged in an order either ascending or descending.

4] an indicator can be used to signal the end of a titration. When selecting an indicator for acid-base titration. choose an indicator whose pH range falls within the pH change of the reaction.

practical Analytical chemistry

*Name: Renad abedelhakim alKhawarah

*Reg. No. : 0201324

*locker No. : 307

*Sec : 9

*Instructor: Dr. Mohammed Amer.

*Exp: Neutralization Titration in Aqueous Media. (3)

10/10

Experiment 3

Date Sheet and Calculations

Name: كرنة لخوره
Reg. No.: 0201329

Section: 9
Date:

Mass of Na_2CO_3	0.5023 ± 0.0001 g
(A) Vol. of Na_2CO_3	Vol. of HCl
1. 10.0 ± 0.05 mL 2. 10.0 ± 0.05 mL 3.	11.5 ± 0.07 mL 11.5 ± 0.07 mL
(B) Vol. of NaOH	Vol. of HCl
1. 10.0 ± 0.05 mL 2. 10.0 ± 0.05 mL 3.	12.5 ± 0.07 mL 12.8 ± 0.07 mL

(C) Vol. of H_3PO_4	Vol. of NaOH	Indicator
1. 10.0 ± 0.05	12.3 ± 0.07	bromocr
2. 10.0 ± 0.05	19.4 ± 0.07	phenolph.

70

Calculate the molarity of Na_2CO_3, HCl and NaOH solutions, and calculate the concentration of H_3PO_4 in the unknown solution in g/L.

Instructor's Signature: .....

Instructor's name: ..... اعتدال جلال

30/3/2022

Wed

*purpose:-

prepare and standardize one solution of an acid and one of a base, and the use of the standardized basic solution to analyze unknown commercial phosphoric acidic solution, in which different indicators are going to be used

*observation:-

neutralization titration of an unknown commercial phosphoric acidic solution (H_3PO_4) by secondary standard (HCl) and primary standard (Na_2CO_3) using different indicators.

*calculations:-

*uncertainty of the Balance ⇒ ±0.0001

*uncertainty → $\frac{1}{2} * 0.1 = \pm 0.05$

*uncertainty → $\sqrt{(0.05)^2+(0.05)^2} = \pm 0.07$

part "A" → (M Na_2CO_3 & HCl)

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

✓ mass $Na_2CO_3 = 0.5023 \pm 0.0001$ g

✓ Mw $Na_2CO_3 = 105.8$ g/mol

↳ moles of $Na_2CO_3 = \frac{mass}{Mw} = \frac{0.5023}{105.8} = 4.747 * 10^{-3}$ mol

$\Rightarrow M(Na_2CO_3) = \frac{mole}{V(L)} = \frac{4.747 * 10^{-3}}{100.0 * 10^{-3}} = 0.04747\ M\ Na_2CO_3$

$* \bar{V}\ HCl = \frac{(11.5)+(11.5)}{2} = 11.5$ mL

↳ $2(MV)_{Na_2CO_3} = (MV)_{HCl}$

$M_{HCl} = \frac{2(0.04747)(10.00)}{11.5} = 0.0825\ M\ HCl$

part "B" → (M NaOH)

$NaOH + HCl \rightarrow NaCl + H_2O$

$\bar{V}_{HCl} = \frac{(12.5)+(12.8)}{2} = 12.6$ mL

↳ $(MV)_{NaOH} = (MV)_{HCl}$

$M_{(NaOH)} = \frac{(0.0825)(12.6)}{10.00} = 0.103\ M\ NaOH$

part "C" → (unKnown 70) 70

1) $H_3PO_4 + NaOH \rightarrow NaH_3PO + H_2O$

↳ indicator : Bromo cresol green.

$\Rightarrow (MV)_{H_3PO_4} = (MV)_{NaOH}$

$M_{H_3PO_4} = \frac{(0.103)(12.3)}{10.00} = 0.126\ M \rightarrow \frac{mol}{L}$

$M_w(H_3PO_4) = 97.9\ g/mol$

$\Rightarrow 0.126\ \frac{mol}{L} * 97.9\ \frac{g}{mol} = 12.40\ g/L$

2) $H_3PO_4 + 2\ NaOH \rightarrow Na_2HPO_4 + 2\ H_2O$

↳ indicator : phenolphthalein.

$\Rightarrow (MV)_{H_3PO_4} = \frac{1}{2}(MV)_{NaOH}$

$M_{H_3PO_4} = \frac{1}{2}\frac{(0.103)(19.4)}{10.00} = 0.099\ M \rightarrow \frac{mol}{L}$

$M_w(H_3PO_4) = 97.9\ g/mol$

$\Rightarrow 0.099\ \frac{mol}{L} * 97.9\ \frac{g}{mol} = 9.781\ g/L$

$\rightsquigarrow$ total concentration $= \frac{(12.4) + (9.781)}{2} = 11.09\ g/L$

* Conclusions:-

A. we have 3 Kinds of titration:

1) strong acid - weak base : $HCl - Na_2CO_3$
2) strong acid - strong base : $HCl - NaOH$
3) strong base - weak acid : $NaOH - H_3PO_4$

B) we can standorize an acid, then use it with other Base in titration and complete calculation

C) Na_2CO_3 is a primary standard.

* Questions (elearning):-

1) equivalence : at wich the amount of tit added is just enough to completely neutralize the analyte solution.

end point : the point where the colour change occurs in a system.

2) 1) High purity.
2) stability.
3) high equivalent weight.

3)

$$\frac{1}{2}(MV)_{HCl} = (MV)_{Na_2CO_3}$$

$$\frac{1}{2}(M)(5) = (0.02)(10)$$

$$M = 0.08\ M\ HCl$$

Question (P.24):-

1) steps:-

a) prepare a standard solution for $Ca(OH)_2$.

b) allow the undissolved $Ca(OH)_2$ to settle down the saturated solution.

c) pipette a certain volume of standard solution of $Ca(OH)_2$.

d) $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$

↳ moles of $Ca(OH)_2 = \frac{1}{2}$ mole of HCl

→ solubility of $Ca(OH)_2 = [Ca^{+2}] = \frac{[OH^-]}{2}$

2) steps:-

a) take a cartain amount of a certain Hydrous and dissolve it in water.

b) Add suitable indicater and titrate with suitable acid

c) calculate the mass of Na_2CO_3 (from molar mass).

d) calculate the mass of H_2O = mass of $Na_2CO_3 \cdot X H_2O$ - mass of Na_2CO_3.

e) calculate moles of H_2O (from molar mass)

f) X = moles of H_2O / moles of Na_2CO_3.

3) Because H_2PO_4 has 3 protons in titration with NaOH and each end point has different pH.

4) No, Because:

a) There is no weak acid - weak base titration.

b) No sharp change in pH.

c) Reversible reaction.

d) Needs large amount to be titrated for each equwalance point.

practical Analytical chemistry.

* Name: Renad abedalhakim

* Reg.No.: 0201324

8/10

* locker No.: 307

* Date: 6/4/2022

* exp: precipitation Titration (Agentometry) / (4)

* Sec. No.: 9

* instructor: Dr. mohammed amer

Experiment 4

Data Sheet and Calculations

Name: رناد الجوره
Reg. No.: 0201324

Section: 9
Date:

Mass of NaCl: 0.6072 ± 0.0001 g

(A) Mohr's method	Trial (1)	Trial (2)
Vol. of NaCl solution Vol. of $AgNO_3$ solution	10.0 ± 0.05 9.70 ± 0.07	10.00 ± 0.05 10.90 ± 0.07
(B) Fajan's method		
Vol. of NaCl solution Vol. of $AgNO_3$ solution	10.00 ± 0.07 12.70 ± 0.07	
(C) Volhard's method		
Vol. of $AgNO_3$ solution Vol. of KSCN solution	10.0 ± 0.05 11.10 ± 0.07	10.00 ± 0.05 11.40 ± 0.07

Unknown mixture ID: 5		
(I) According to Mohr's method	Trial 1	Trial 2
Vol. of unknown solution Vol. of $AgNO_3$ solution	10.0 ± 0.05 11.50 ± 0.07	10.00 ± 0.05 10.30 ± 0.07
(II) According to Volhard's method		
Volume of unknown solution Vol. of KSCN solution		
Vol. of $AgNO_3$ added in excess		

Instructor's Signature: .....

Instructor's Name: .....

6/4/2022

* calculation ⇒

(A) Mohr's method ⇒

$Ag^+ + Cl^- \rightleftharpoons AgCl$ (white)

$2Ag^+ + CrO_4^{-2} \rightleftharpoons Ag_2CrO_4$ (reddish brown)

→ $\bar{V}_{AgNO_3} = (9.70 + 10.9)/2 = 10.3$ mL

→ wt of Nacl = 0.6072 ± 0.0001 g

→ Mw of Nacl = 58.5

→ Volume of Nacl = 100 mL

⇒ $n_{(Nacl)} = \frac{m}{M_w} = \frac{0.6072\ g}{58.5\ (g/mol)} = 0.0103$ mol

⇒ $M_{(Nacl)} = \frac{n}{V} = \frac{0.0103\ mol}{100 \times 10^{-3}\ L} = 0.103$ mol/L

⇒ $MV_{(Nacl)} = MV_{(AgNO_3)}$

$(0.103) \times (10.0) = M(10.3) \rightarrow M_{(AgNO_3)} = \underline{\underline{0.1\ M_{(AgNO_3)}}}$

↳ $0.1\ \frac{mol}{L} \times \overset{\text{Mw } AgNO_3}{169.8\ \frac{g}{mol}} = \underline{\underline{16.98}}$ g/L $(AgNO_3)$

(b) Fajan's method ⇒

$Nacl + AgNO_3 \rightleftharpoons AgCl$ (white)

→ $V_{(AgNO_3)} = 12.7$ mL, $n_{(Nacl)} = 0.0103$ mol, $M_{(Nacl)} = 0.103$ M

⇒ $MV_{(Nacl)} = MV_{(AgNO_3)}$

$(0.103)(10.0) = M(12.7) \rightarrow M_{(AgNO_3)} = \underline{\underline{0.0811\ M}}\ (AgNO_3)$

↳ $0.0811\ \frac{mol}{L} \times \frac{169.8\ g}{mol} = \underline{\underline{13.77}}$ g/L $(AgNO_3)$

* the mean values of Both methods ⇒

1) for <u>molarity</u> $(AgNO_3) = ((0.1) + (0.0811))/2 = \underline{0.09055\ M.}$

2) for <u>g/L</u> $(AgNO_3) = ((16.98) + (13.77))/2 = \underline{15.375\ g/L}$

Volhard's method ⇒

$Ag^+ + SCN \rightleftharpoons AgSCN_3$ (white)

$Fe^{+3} + SCN^- \rightleftharpoons [Fe(SCN)]^{+2}$ (red-brown)

→ $\bar{V}(KSCN) = ((11.1)+(11.4))/2 = 11.25$ mL

→ $\bar{M}(AgNO_3) = 0.09055$ M ($AgNO_3$)
from part A.B

⇒ $MV_{(AgNO_3)} = MV_{(KCSN)}$

$(0.09055)(10.0) = M(11.25)$ → $M_{(KCSN)} = 0.0804$ M (KCSN)

↳ $0.0804 \frac{mol}{L} \times \frac{97.1 g}{mol} = 7.80684$ g/L

(D) I. According to Mohr's method ⇒

→ $\bar{V}(AgNO_3) = ((11.5)+(10.3))/2 = 10.9$ mL

→ $n_{(AgNO_3)} = M \times \bar{V} = (0.09055) \times (10.9 \times 10^{-3}) = 9.86 \times 10^{-4}$

→ wt of the mixture $(X+Y = 0.065 g)$, $X = 0.065 - Y$

$X + Y = 0.065$ g
$X \rightarrow$ g (Nacl)
$Y \rightarrow$ g (Kcl)
$\frac{X}{58.5} + \frac{Y}{74.5} = (MV)$ for Ag^+

$mol_{(Nacl)} + mol_{KCl} = mol_{(AgNO_3)}$

$$\frac{X}{Mw_{Nacl}} + \frac{Y}{Mw_{KCl}} = 9.86 \times 10^{-4}$$

$$\frac{(0.065 - Y)}{58.5} + \frac{Y}{74.5} = 9.86 \times 10^{-4}$$

⇝ $Y = 0.03408$ g , ⇒ $X = 0.03092$ g

✓ $\frac{mass\ (KCl)}{V(L)} = \frac{0.03408 g}{10.0 \times 10^{-3} L}$

$= 3.408$ g/L
(Kcl)

✓ $\frac{mass\ (Nacl)}{V(L)} = \frac{0.03092 g}{10.0 \times 10^{-3} L}$

$= 3.092$ g/L
(Nacl)

-3

* Questions (P:28) ⇒

1) Because in Basic media (Ag^+) will react with (OH^-) from the Base producing ($AgOH$) and this will increase the volume needed of $AgNO_3$ to titrate NaCl solution, as well as in acidic media $Cr_2O_3^{-2}$ will be formed which means that active errors will accur- so the neutral media is the best media.

2) Because in Fajan's method we use fluresen indicator which in acidic media solution will react with H^+ from the acid to form (HF), so the indicator will be consumed to form the acid, so we need to add more of the ($AgNO_3$) to reach the end point (until the solution becames pink) so we will have possitive error.

3) $K_{sp}(Ag_2Cr_2O_7) > K_{sp}(K_2CrO_4)$, so it is more soluble, so reacing to the end point will need less volume of titrant so the volume of $AgNO_3$ would increase.

4) The volume of $AgNO_3$ will increase becase of the reaction of Ag^+ with OH^- from the base (in Mohr's & Fajan's method), so $AgOH_{(s)} \rightarrow Ag_2O_{(ppt)}$ very large positive error.
but in Volhards method: Fe^{+3} will react with OH to form $Fe(OH)_3$
$\rightarrow Fe(OH)_3 \rightarrow Fe_2O_3$ so we need more Ag^+ so positive error.

5) because nitro benzene is added in case of titration of Cl^- by the volhards method reaction such as $AgCl + SCN \rightarrow AgSCN + Cl$.
AgCl is more soluble than AgSCN
K_{sp} AgCl > K_{sp} AgSCN.

practical Analytical chemistry

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*Section:- 9

* Instructor:- Dr. Mohammed Amer.

* Date:- 13/4/2022

*Exp: Redox Titration (Dichromate titration) (5)

8/10 +C

Experiment 5

Data Sheet and Calculations

Name: Renad abedalhakim
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Section: 9
Date: 6/4/2022

Unknown ID No.: 5	
(A) Determination of Fe^{2+} in a mixture	
Vol. of unknown solution ±0.05	Vol. of $K_2Cr_2O_7$ ± 0.07
1) 10.00 ±0.05	5.30 ±0.07 4.90 ± 0.07
2) 10.00 ±0.05	4.30 ±0.07
3)	
(B) Determination of Fe^{3+} after reduction	
Vol. of unknown solution	Vol. of $K_2Cr_2O_7$ ±0.07
1) 10.00 ± 0.05	5.20 ± 0.07
2) 10.00 ± 0.05	4.80 ± 0.07

Wt. of Fe^{2+} per liter =
Wt. of Fe^{3+} per liter =

Instructor's signature: .....

Instructor's Name: .....

calculation 8-

A. $6Fe^{+2} \rightarrow 6Fe^{+3} + 6e^-$

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

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

$\rightarrow \bar{V}(Cr_2O_7^{-2}) = (4.90 + 4.30)/2 = 4.60$

$\rightarrow n(Cr_2O_7^{-2}) \Rightarrow M \times V \rightarrow (0.02) \times (4.60 \times 10^{-3}) = 9.2 \times 10^{-5}$ mol $(Cr_2O_7^{-2})$

$\rightarrow n(Fe^{+2}) \rightarrow 1$ mol $(Cr_2O_7^{-2}) \rightarrow 6$ mol $(Fe^{+2}) \Rightarrow 5.52 \times 10^{-4}$ mol (Fe^{+2})

$9.2 \times 10^{-5} (Cr_2O_7^{-2}) \rightarrow ?$ mol (Fe^{+2})

$\Rightarrow M(Fe^{+2}) = \frac{n}{V} = \frac{5.52 \times 10^{-4}}{10 \times 10^{-3}} = 0.0552\ M\ (Fe^{+2})$, $M_w(Fe) = 55.8$ g/mol

$\hookrightarrow 0.0552 \frac{mol}{L} \times \frac{55.8\ g}{mol} = 3.08$ g/L

-2

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

$Fe^{+3} + Zn \rightarrow Fe^{+2} + Zn^{+2}$

$\rightarrow \bar{V}(Cr_2O_7^{-2}) = 5.00$ mL

$\rightarrow n(Cr_2O_7^{-2}) = M \times V = 0.02 \times 5.00 \times 10^{-3} = 1.0 \times 10^{-4}$ mol $(Cr_2O_7^{-2})$

$\rightarrow n(Fe^{+2}) = 1$ mol $(Cr_2O_7^{-2}) \rightarrow 6$ mol $(Fe^{+2}) \Rightarrow 6 \times 10^{-4}$ mol (Fe^{+2})

$10 \times 10^{-4} (Cr_2O_7^{-2}) \rightarrow ?$ mol (Fe^{+2})

$\Rightarrow M(Fe^{+3}) = \frac{n}{V} = \frac{6 \times 10^{-4}}{10 \times 10^{-3}} = 0.06\ M\ (Fe^{+2})$, $M_w(Fe) = 55.8$

2

$\hookrightarrow 0.06 \frac{mol}{L} \times \frac{55.8\ g}{mol} = 3.34$ g/L

$\Rightarrow Fe^{+3}(g/L) = Fe^{+2}_c - Fe^{+2}_A = (3.34) - (3.08)$

$= 0.268$ g/L

* Question 8-

1) H_3PO_4 forms colorless mixture with Fe^{+3}, so that the yellow color of Fe^{+3} will not appear in the solution, so while titration we will detect the end point easily and also it has lower pointed differce.

2) yes, because iron contains Fe_2O_3 and Fe_3O_4 which can be dissolved in acidic solution to get $Fe^{+3} \rightarrow Fe^{+2}$ by Johnes reductor then with $Cr_2O_7^{-2}$ using H_3PO_4 and diphenylamine sulfonic acid indicator.

3) after making a solution of Zinc amulgam, we add the unknown mixture with H_2SO_4 and boil them until the yellow color disappear, this confirm that all Fe^{+3} to Fe^{+2} to check the complete reduction of Fe^{+3} one drop of the solution is added forms that mean we have complete reduction of Fe^{+3} to Fe^{+2}

practical Analytical chemistry

*Name: Renad abedalhakim

*Reg. No: 0201324

* locker No: 307

* Sec: 9, Dr. Mohamed Amer

* Date: 27/4/2022

* exp: Redox Titration (Iodine titration) "6"

9.5/10

Experiment 6

Data Sheet and Calculations

Name: Renad abdalhakim
Reg. No.: 0201324

Section: 9
Date: 27/4/2022

(A) Standardization of 0.1M thiosulfate	
Wt of KIO_3 = 0.4190 g ±0.0001	
Volume of KIO_3 ±0.05	Volume of $Na_2S_2O_3$ ±0.07
1- 10.00 ± ml	12.8 ± ml
2- 10.00 ± ml	12.5 ± ml
3- ml	ml

(B) Standardization of 0.1M iodine:	
Volume of I_2 ±0.05	Volume of $Na_2S_2O_3$ ±0.07
1- 10.00 ± ml	26.2 ± ml
2- 10.00 ± ml	27.4 ± ml
3- ml	ml

(C) Determination of tin in the unknown:		
Unknown ID # : 9		
Volume of I_2 ±0.05	volume the unknown solution ±0.05	Volume of $Na_2S_2O_3$ ±0.07
1- 15.00 ± ml	10.00 ± ml	ml 25.2 ±
2- 15.00 ± ml	10.00 ± ml	ml 22.3 ±
3- ml	ml	ml

Instructor's Signature: Mana
Instructor's Name: Manar Adi
27.4.2022

* Calculation :-

A $KIO_3 + 5KI + 6HCl \rightarrow 3I_2 + 3H_2O + 6KCl$

$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$

→ (V) KIO_3 = 10.00 mL , wt. KIO_3 = 0.4190 g , Mw. KIO_3 = 214 g/mol

→ ($\bar{V}$) $Na_2S_2O_3$ = 12.65 mL , Mw. $Na_2S_2O_3$ = 158 g/mol

* $n(KIO_3) = 1.95 \times 10^{-3}$ mol (KIO_3) → $M(KIO_3) = \frac{1.95 \times 10^{-3}}{100 \times 10^{-3}} = 0.0195\ M(KIO_3)$

* $1(KIO_3) \rightarrow 3I_2$ ⇒ $n(I_2) = 5.85 \times 10^{-3}$ mol (I_2)

$1.95 \times 10^{-3}(KIO_3) \xrightarrow{X} ?$

* $1(I_2) \rightarrow 2S_2O_3^{2-}$ ⇒ $n(S_2O_3^{-2}) = 11.7 \times 10^{-3}$ mol ($S_2O_3^{-2}$)

$5.85 \times 10^{-3} \xrightarrow{X} ?$

∴ So: $n_{(KIO_3)} = \frac{n(S_2O_3^{-2})}{6}$ → $MV_{KIO_3} = MV_{S_2O_3^{-2}}$ ⇒ $M_{S_2O_3^{-2}} = \frac{(0.0195)(10 \times 10^{-3})(6)}{12.65 \times 10^{-3}}$

↳ $M_{S_2O_3^{-2}} = \boxed{0.0924\ M}$ ($S_2O_3^{-2}$) → $0.0924 \frac{mol}{L} \times 158 \frac{g}{mol} = 14.6\ g/L$

B $I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2I^-$

→ (V) I_2 = 10.00 mL , Mw. I_2 = 253 g/mol

0.5

→ ($\bar{V}$) $Na_2S_2O_3$ = 26.8 mL

* $n_{I_2} = \frac{n_{S_2O_3^-}}{2}$ → $MV_{I_2} = \frac{MV_{S_2O_3^-}}{2}$ ⇒ $M_{I_2} = \frac{(0.0924)(26.8)}{(2)(10)} = \boxed{0.123\ M}$ (I_2)

↳ $0.123 \frac{mol}{L} \times \frac{253\ g}{mol} = 31.32\ g/L$

E $Sn^{+2} + I_2 \rightarrow Sn^{+4} + 2I^-$

$I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2I^-$

Unk # 9

→ (V) I_2 = 15.00 mL

→ (V) unknown = 10.00 mL , Mw Sn^{+2} = 118.7 g/mol

→ (V) $S_2O_3^{-2}$ = 23.75 mL

* $n_{I_2} = n_{Sn^{+2}}$, → $n_{Sn^{+2}} = n_{I(Total)} - n_{I(react\ with\ S_2O_4^{-2})}$ → $MV_{(I)} - \frac{MV_{S_2O_4^{-2}}}{2} = MV_{Sn}$

↳ $(0.123)(15) - \frac{(0.0924)(23.75)}{2} = M(10)$ ⇒ $M = 0.074\ M\ Sn^{+2}$

* $0.074 \frac{mol}{L} * 118.7 \frac{g}{mol} = 8.87\ g/L$

*Question ⇒ p. 40

1) In acidic medium air oxidize I_2 and a hydrolysis of starch accrue:

$4I^- + O_2 + 4H^+ \rightarrow 2I_2 + 2H_2O$ (+ve error)

In alkaline medium: $I_2 + 2OH^- \rightarrow I^- + IO^- + H_2O$ (-ve error) see

2) To be sure there are no bacteria or air that may oxidize $Na_2S_2O_3$.

3) To: A) Prevent oxidation of I^- by O_2.

B) prevent locate of thio-sulphate, because it is decomposed to produce sulfer.

4) It's from blanket of CO_2 over the solution, which contains I^- to avoid oxidation

practical Analytical chemistry

*Name: Renad abedalhakim

*Reg No: 0201324

*locker No: 307

8/10

*Date: 11/5/2022

*exp: complex titration using EDTA (7)

*Sec: (9), Dr. Mohamed amer

Experiment 7

Data Sheet and Calculations

Name: Renad abdalhakim Section: 9

Reg. No.: 0201324 Date: 11/5/2022

(A) Standardization of EDTA				
Mass of $ZnSO_4.7H_2O$	0.3408 ± 0.0001 g			
Data	Trial 1	Trial 2	Trial 3	Average
Volume of $ZnSO_4.7H_2O$ Solution ±0.05	10.00	10.00		
Volume of EDTA solution ±0.07	19.2	18.6		
Molarity of EDTA solution	5.7×10^{-3}	5.9×10^{-3}		

(B) Determination of Water Hardness				
Data	Trial 1	Trial 2	Trial 3	Average
1- Vol. of tap water ±0.05	50		±0.1	
2- Vol. of EDTA solution (V_1) ±0.07 (corresponding to Ca and Mg)	15.60	0	±0.02	
3- Vol. of tap water ±0.05	50			
4- Vol. of EDTA (V_2) (corresponding to Ca) ±0.07	8.3			

Data	Trial 1	Trial 2	Trial 3	Average
Volume of EDTA corresponding to Mg (V_1-V_2) ±0.07	7.3			
ppm Ca	38.7			
ppm Mg	20.6			
Water hardness (mg $CaCO_3$/L)	181.4			

(C) Unknown solution 44

Unknown ID No.				
Data	Trial 1	Trial 2	Trial 3	Average
1. Vol. of unknown solution ±0.05	10mL	10mL		
2. Vol. of EDTA solution ±0.07	36.5	37.2		
3. ppm Ca and Mg				
4. Vol. of unknown solution ±0.05	10mL	10 mL		
5. Vol. of EDTA solution ±0.07	28.7	29.2		
6. ppm Ca				

Instructor's Signature: .....

Instructor's Name: .....

11/5/2022

* Calculation :-

A] • $ZnSO_4 \cdot 7H_2O$ < mass = 0.3408 g, M_w = 287 g/mol → $n = 1.187 * 10^{-3}$ mol , $M = \frac{1.187 * 10^{-3}}{100 * 10^{-3}} = 0.011$ M

• $\bar{V}_{EDTA} = 18.9$ mL

⇒ $MV_{ZnSO_4 \cdot 7H_2O} = MV_{EDTA}$

$(0.011)(10) = (M)(18.9)$ ⇒ $M = 5.82 * 10^{-3}$ M (EDTA)

B] (a) • $V_{water} = 50$ mL , $V_{EDTA(V_1)} = 15.60$ mL , $V_{EDTA(V_2)} = 8.3$ mL | $M_{w\,Ca} = 40.1$ g/mol, $M_{w\,Mg} = 24.3$ g/mol

⇝ $V_{EDTA(V_1 - V_2)} = 7.3$ mL

⇒ $MV_{EDTA} = MV_{Ca}$

$(5.82 * 10^{-3})(8.3) = M(50)$ ⇝ $M = 9.661 * 10^{-4}$ M (Ca)

↳ in ppm = $M_{Ca} * M_{w\,Ca} * 1000 = 38.7$ (ppm) → Ca

→ $n_{EDTA(V_1)} = M * V_1 = (5.82 * 10^{-3})(15.6 * 10^{-3}) = 9.07 * 10^{-5}$ mol

→ $n_{EDTA(V_2)} = M * V_2 = (5.82 * 10^{-3})(8.3 * 10^{-3}) = 4.83 * 10^{-5}$ mol

⇝ $n_{Mg} = n_{V_1} - n_{V_2}$ ⇒ $4.24 * 10^{-5}$ mol ⇒ $M_{Mg} = \frac{4.24 * 10^{-5}}{50 * 10^{-3}} = 8.48 * 10^{-4}$ M (Mg)

↳ in ppm = $M_{Mg} * M_{w\,Mg} * 1000 = 20.6$ ppm → Mg

(b) water hardness →

$(n_{Ca} + n_{Mg}) = (M * 50 * 10^{-3})$.

$(9.07 * 10^{-5}) = M * 50 * 10^{-3}$ ⇝ $M = 1.814 * 10^{-3}$ M , $M_{w(CaCO_3)} = 100$ g/mol

→ in ppm = 181.4 ppm
↳ mg/L

ج. $V_{unknown} = 10$ mL , $\bar{V}_{EDTA} = 36.85$ mL , $\bar{V}_{EDTA_{Ca}} = 28.95$ mL

$\rightarrow n_{EDTA} = (5.82 \times 10^{-3})(36.85 \times 10^{-3}) = 2.14 \times 10^{-4}$ mol

$\rightarrow n_{EDTA} = (5.82 \times 10^{-3})(28.95 \times 10^{-3}) = 1.68 \times 10^{-4}$ mol

$\rightarrow MV_{EDTA} = MV_{unk}$

$(5.82 \times 10^{-3})(36.85) = M(10) \rightarrow M = 0.02\,M$, in ppm: 2144.67 ppm

$\rightarrow MV_{EDTA} = MV_{Ca}$

$(5.82 \times 10^{-3})(28.95) = M(10) \rightarrow M = 0.01\,M$, in ppm: 675.64 ppm

$\rightarrow n_{mg} = n_{unkn} - n_{Ca} \Rightarrow (2.14 \times 10^{-4}) - (1.68 \times 10^{-4}) = 4.6 \times 10^{-5}$ mol (mg)

$\rightarrow M = \frac{4.6 \times 10^{-5}}{10 \times 10^{-3}} = 4.6 \times 10^{-3}\,M$, in ppm = 111.78 ppm

analytical chemistry lab

Name: Renad abedalhakim

Reg. No: 0201324

Locker No: 307

sec: 9

Date: 20/4/2022

10

Instructor: Dr. Mohmmed Amer

exp: Determination of calcium by quantitative precipitation (8)

Experiment 8

Data Sheet and Calculations

Name: Rewad abdalhakim Section: 9

Reg. No.: 201324 Date: 20/4/2022

Unknown ID No.:	
(A) Standardization of $KMnO_4$	
Mass of Sodium oxalate 0.6030 ± 0.0001 g per 100 mL Molarity of sodium oxalate	
Vol. of $Na_2C_2O_4$ solution	Vol. of $KMnO_4$
1) 10.00 ± 0.05 2) 10.00 ± 0.05 3) 10.00 ± 0.05	9.05 ± 0.07 9.00 ± 0.07 8.90 ± 0.07
Molarity of $KMnO_4$ solution Concentration of $KMnO_4$ in g/L:	
(B) Precipitation and Titration of Ca^{2+}	
Vol. of Ca^{2+} solution	Vol. of $KMnO_4$
1) 10.00 ± 0.05 2) 3)	29.90 ± 0.07
Concentration of Ca^{2+} solution in g/L	

Instructor's Signature: .....

Instructor's Name: .....

Calculation :-

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

→ wt. $C_2O_4^{-2} = 0.6030$ g + 0.0001

→ M_w $Na_2C_2O_4 = 134$ g/mol

→ M_w $KMnO_4 = 158$ g/mol

→ $\bar{V}$ $(KMnO_4) = 8.98$ mL

→ $n(Na_2C_2O_4) = \frac{0.6030}{134} = 4.5 \times 10^{-3}$ mol ⇒ $M(Na_2C_2O_4) = \frac{4.5 \times 10^{-3}}{100 \times 10^{-3}} = 0.045\ M\ (Na_2C_2O_4)$

→ $M(KMnO_4) \Rightarrow \frac{(M_1V_1)_{KMnO_4}}{2} = \frac{(M_2V_2)_{Na_2C_2O_4}}{5}$

$= \frac{M_1(8.98)}{2} = \frac{(0.045)(10)}{5} \Rightarrow M_{KMnO_4} = 0.020\ M\ (KMnO_4)$

↳ $0.020 \frac{mol}{L} \times 158 \frac{g}{mol} = 3.16$ g/L

[B] $Ca^{+2} + C_2O_4^{-2} \rightleftharpoons CaC_2O_4$

$CaC_2O_4 + H_2SO_4 \rightarrow CaSO_4 + H_2C_2O_4$

$2MnO_4^- + 5H_2C_2O_4 + 6H^+ \rightarrow 2Mn^{+2} + 10CO_3 + 8H_2O$

→ M_w $(Ca^{+2}) = 40$ g/mol

→ $V(KMnO_4) = 29.90$ mL

→ $V(Ca^{+2}) = 10.00$ mL

→ $\frac{MV_{(Ca^{+2})}}{5} = \frac{MV_{(KMnO_4)}}{2}$

$\frac{M(10)}{5} = \frac{(0.020)(29.90)}{2} \Rightarrow M_{(Ca)} = 0.1495\ M\ (Ca^{+2})$

↳ $0.1495 \frac{mol}{L} \times 40 \frac{g}{mol} = 5.98$ g/L (Ca^{+2})

* Question ⇒ (P 51)

1) To obtain a basic solution since this precipitation only occurs in a basic condition (Methyl Red has (4.5-6.5 pH).

2) To remove Cl^- and $C_2O_4^{-2}$ ions completely from it (+ve error).

3) Errors :-

a) Incomplete precipitation

b) Incomplete washing

c) Incomplete dissolving CaC_2O_4 with H_2SO_4.

Practical Analytical chemistry

Name: Renad abed alhakim

Reg. No: 0201324

Laker No.: 307

Sec. No: 9

nstractor: Mohammad Amer.

Date: 23/3/2022

Exp: Gravimetric determination of sulfate. (9)

~~10~~

9.5/10

Experiment 9

Data Sheet and Calculations

Name: Section:

Reg. No.: Date:

Unknown ID No.:	
Vol. of unknown solution ±0.05	10.00 mL
Mass of empty crucible ±0.0001	16.7334 g
Mass of crucible + precipitate ±0.0001	17.3425 g
Mass of precipitate ($BaSO_4$) ±0.0001	0.6091 g
Mass of sulfate	0.251 g
Concentration of sulfate in mg/L	2.510×10^4 mg/L

Instructor's Signature: .....

Instructor's Name: .....

* purpose + main observation ⇒

Determination of sulfate ions concentration in an unknown solution by precipitation as barium sulfate.

↳ main observation → change the color

* Calculations ⇒

→ Mass of precipitate ($BaSO_4$) = (mass of crucible + precipitate) − (mass of crucible)

↳ 17.3425 − 16.7334 = $\boxed{0.6091\ g}$

↳ uncertainty → $\sqrt{(0.0001)^2 + (0.0001)^2} = \boxed{\pm 0.0001}$

→ Fw SO_4 = (1 * 32.06) + (4 * 16) = $\boxed{96.06\ g/mol}$

* Fw $BaSO_4$ = (1 * 137.33) + (1 * 32.06) + (4 * 16) = $\boxed{233.39\ g/mol}$

* mass of SO_4^{-2} = wight of $BaSO_4$ * $\frac{Fw\ SO_4}{Fw\ BaSO_4}$

↳ $0.6091 * \frac{96.06}{233.39} = \boxed{0.251\ g}$

in part A ↳

Volume of unknown = 10.00 mL ±0.05 (using a pipet)

↳ concentration of sulfate in mg/L →

$V(L) = 10 * 10^{-3}\ L$

$m(mg) = 0.251 * 10^{3}\ mg$

→ $M = \frac{m(mg)}{V(L)} = \frac{0.251 * 10^3}{10 * 10^{-3}} = \boxed{2.51 * 10^4\ mg/L}$

0.257 = 2.50 for 0.5

∴ 2500 mg/L

* Questions ⇒ P(64)

1] a) prevent co-precipitate of Ba^{-2}

B) Force precipitate to form larger crystals and so making filtration.

c) prevent any crystals passing with filtrate throw the filter paper

2] to 1) prevent inclusion and occlusion

2) Ensure that only $BaSO_4$ precipitate.

3] to prevent coprecipitation

4] to prevent reduction of $BaSO_4$ by carbon:

$BaSO_4 + 4C \rightarrow BaS + 4CO$, Because $BaSO_4$ is easily produced by carbon $T > 600\ C^{\circ}$

* conclusion:-

✓ All reading were close to their averges, so there was high precision

✓ There were some loses in precipitate during the experiment

Experiment 10

Data Sheet and Calculations

Name: Renad alKhawarah Section: 9

Reg. No.: 0201324 Date: 18/5

Unknown ID No.:	
Volume of solution used	10.00 ± 0.05 mL
Mass of empty crucible	303.890 ± 0.0001 g
Mass of empty crucible +Ni(DMG)$_2$	305.462 ± 0.0001 g
Mass of Ni(DMG)$_2$ precipitate	1.572 g
Mass of Ni	0.3221 g
Mass of Ni per liter solution (mg/L)	$3.221 * 10^4$ mg/L

9.5/10

-0.5

Instructor's Signature: .....

Instructor's Name: .....

* Calculation :-

$$Ni^{+2} + 2DMG \rightarrow Ni(DMG)_2 + 2H^+$$

→ Vol of Ni^{+2} = 10.00 mL

→ Mass $Ni(DMG)_2$ = 1.572 g

→ M_w $Ni(DMG)_2$ = 286.76 g/mol / M_w Ni = 58.76 g/mol

$$\therefore m_{Ni^{+2}} = m_{Ni(DMG)_2} * \frac{M_w\ Ni}{M_w\ Ni(DMG)_2} \rightarrow n\ (Ni)$$

$$= 1.572 * \frac{58.76}{286.76} = 0.3221\ g$$

$$\therefore \text{concentration } Ni^{+2} (mg/L) = \frac{0.3221}{10 * 10^{-3}} * 1000 = 32211.8\ mg/L = 3.221 * 10^4\ mg/L$$

* Question :-

1. Becaus the basic solution decrease the solubility of the ppt:

$$Ni + 2DMG \xrightarrow{\text{will be shifted to the right}} Ni(DMG)_2 + 2H^+ \downarrow$$

2. Because $Ni(DMG)_2$ will creep up the walls of container.

3. By washing the precipitate with warm distiled water with 30% ethanol.

4. To get rid of the excess DMG from the precipitate, and if it was 100% it will dissolve the precipitate.