

practical Analytical chemistry

*Name: Renad abed alhakim alKawarrah.

*Reg.No: 0201324

*Locker no: 307

*Section: 9

*Instructor: Mohammad Amer

*Date: 9-3-2022

*experiment: exp 1, Volumetric glassware and Balances.

8/10



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 ± 0.001	6.6319 ± 0.001	6.6417 ± 0.001
Weight of flask and water	11.7389 ± 0.001	11.7495 ± 0.001	11.6851 ± 0.001
Weight of water, g	5.1134 ± 0.001	5.1176 ± 0.001	5.0434 ± 0.001
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: _____

9/9/2022

ask believe & receive

* Purpose $\Rightarrow$

weighing on the analytical balance and calibration of volumetric glassware.

* Main observation of the experiment $\Rightarrow$

calibrate certain measurement by using volumetric glassware.

ref: practical Analytical chemistry.

ref: bartleby.com

* calculations $\Rightarrow$

Apparent volume, mL :-

* trial 1 $\Rightarrow 6.00 - 1.00 = 5.00$ mL

* trial 2 $\Rightarrow 11.20 - 6.00 = 5.2$ mL

* trial 3 $\Rightarrow 16.00 - 11.20 = 4.8$ mL

• uncertainty :-

* Balance = ± 0.0001 * buret = $1/2 * 0.1 = \pm 0.05$ * Thermometer = $1/2 * 1.0 = \pm 0.5$

* Buret (apparent volume) = $\sqrt{(0.05)^2 + (0.05)^2} = \pm 0.07$

weight of water (g) :-

* trial 1 $\Rightarrow 11.7389 - 6.6255 = 5.1134$ g

* trial 2 $\Rightarrow 11.7495 - 6.6319 = 5.1176$ g

* trial 3 $\Rightarrow 11.6861 - 6.6417 = 5.0434$ g

• uncertainty of the weight of water : $\sqrt{(0.0001)^2 + (0.0001)^2} = \pm 0.0001$

Temperature :- $17^\circ\text{C} \pm 0.5$, (for 1 g at $17^\circ\text{C} \rightarrow 1.0023$ mL) (-)

* trial 1 $\Rightarrow 1 \text{ g} \rightarrow 1.0023 \text{ mL}$
 $5.1134 \text{ g} \rightarrow ? \rightarrow 5.1251 \text{ mL (actual volume)}$

* trial 2 $\Rightarrow 1 \text{ g} \rightarrow 1.0023 \text{ mL}$
 $5.1176 \text{ g} \rightarrow ? \rightarrow 5.1293 \text{ mL (actual volume)}$

* trial 3 $\Rightarrow 1 \text{ g} \rightarrow 1.0023 \text{ mL}$
 $5.0434 \text{ g} \rightarrow ? \rightarrow 5.0549 \text{ mL (actual volume)}$

Correction: $\text{trial 1} \Rightarrow 5.1251 - 5.00 = 0.1251 \text{ mL}$

* trial 2 $\Rightarrow 5.1293 - 5.2 = -0.07 \text{ mL}$

* trial 3 $\Rightarrow 5.0549 - 4.8 = 0.2549 \text{ mL}$

* 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.

* Questions :-

1) dispensing liquids Too quickly.

2) cleaning Irregularly or Not at all.

3) using the wrong pipette Tips.

2) correction = actual - apparent $\Rightarrow 10.0356 - 10.00 = 0.0356 \text{ mL}$

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 $25^\circ\text{C} \rightarrow 1.0038 \text{ mL}$

$$\begin{array}{l} 1 \text{ g} \rightarrow 1.0038 \text{ mL} \\ \times \\ 24.976 \text{ g} \rightarrow ? \end{array} \rightarrow \text{actual Volume} = 25.071 \text{ mL}$$

2) at $20^\circ\text{C} \rightarrow 1.0028 \text{ mL}$

$$\begin{array}{l} 1 \text{ g} \rightarrow 1.0028 \text{ mL} \\ \times \\ 24.976 \text{ g} \rightarrow ? \end{array} \rightarrow \text{actual Volume} = 25.046 \text{ mL}$$



practical Analytical chemistry

Name: Renad abed alhakim.

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Laker No: 307 .

Sec.No: 9 .

Instructor: Mohammad Amer

Date: 16/3/2022 .

exp: sampling and Statistical Handling Data. (2)

9/10



Experiment 2
Data Sheet and Calculations

22.2

Name:

Section:

Reg. No.:

Date: 27.05.22

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 statistical treatment of analytical data.

ref:
practical analytical
chemistry.

* Main observation of the exp:-

practices statistical treatment of analytical data

* Calculation:- $\text{CH}_3\text{COOH} + \text{NaOH} \rightleftharpoons \text{CH}_3\text{COONa} + \text{H}_2\text{O}$

Homogenues $\Rightarrow$

01) $V_s - V_B \rightarrow$

$$\cdot \text{trail (1)}: 10.9 - 0.1 = 10.8$$

$$\cdot \text{trail (2)}: 11.3 - 0.1 = 11.2$$

$$\cdot \text{trail (3)}: 10.8 - 0.1 = 10.7$$

$$\cdot \text{trail (4)}: 11.2 - 0.1 = 11.1$$

$$\cdot \text{trail (5)}: 11.6 - 0.1 = 11.5$$

* uncertainty $\rightarrow$

$$\cdot V_s \rightarrow V_f - V_i = \sqrt{(0.05)^2 + (0.05)^2} = 0.07$$

$$\cdot V_B \rightarrow 0.05 \rightarrow 1/2 + \text{last digit} = 1/2 + 0.1 = 0.05$$

$$\cdot V_s - V_B = \sqrt{(0.05)^2 + (0.07)^2} = 0.09$$

(2) Q test $\rightarrow$ ($Q_{\text{critical}} = 0.642$)

$$\Rightarrow 10.7, 10.8, 11.1, 11.2, 11.5$$

$$\hookrightarrow Q_{\text{exp}} = \frac{|11.2 - 11.5|}{11.5 - 10.7} = 0.375 < Q_{\text{critical}} \rightarrow \text{Accepted.}$$

$$\hookrightarrow Q_{\text{exp}} = \frac{|10.7 - 10.8|}{11.5 - 10.7} = 0.125 < Q_{\text{critical}} \rightarrow \text{Accepted.}$$

(3) mean ($\bar{x}$) $\rightarrow \frac{1}{n} \sum x \rightarrow 11.06$

(4) median ($\bar{y}$) $\rightarrow 11.1$

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

(6) Relative average deviation from the mean $\rightarrow \frac{\sum |x - \bar{x}|}{n \bar{x}} \times 100\% = 2.24\%$

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

(8) Relative average deviation from the median $\rightarrow \frac{\sum |x - \bar{y}|}{n \bar{y}} \times 100\% = 2.17\%$

non-homogenous $\Rightarrow 0$

(1) $V_s - V_B \rightarrow$

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

* uncertainty $\rightarrow$

$$V_s \rightarrow V_s - V_f \rightarrow \sqrt{(0.05)^2 + (0.05)^2} = 0.07$$

$$V_B \rightarrow 0.05 \rightarrow 1/2 + 1 \text{ less deviation} = 1/2 \times 0.1 = 0.05$$

$$V_s - V_B \rightarrow \sqrt{(0.07)^2 + (0.05)^2} = 0.09$$

(2) Q-test $\rightarrow$ ($Q_{\text{critical}} = 0.642$)

$$\Rightarrow 9.8, 10.0, 12.0, 12.5, 12.7$$

$$LQ_{\text{exp}} = \frac{|12.5 - 12.7|}{12.7 - 9.8} = 0.068 < Q_{\text{critical}} \rightarrow \text{accepted}$$

$$LQ_{\text{exp}} = \frac{|9.8 - 10.0|}{12.7 - 9.8} = 0.068 < Q_{\text{critical}} \rightarrow \text{accepted}$$

(3) mean ($\bar{x}$) $\rightarrow \frac{1}{n} \sum x \rightarrow 11.4$

(4) median ($\bar{y}$) $\rightarrow 12.0$

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

(6) Relative average deviation from the mean $\rightarrow \frac{\sum |x - \bar{x}|}{n \bar{x}} \times 100\% = 10.52\%$

(7) average deviation from the median $\rightarrow \frac{\sum |x - \bar{y}|}{n \bar{y}} \times 100\% = \frac{5.4}{5} = 1.08$

(8) Relative average deviation from the median $\rightarrow \frac{\sum |x - \bar{y}|}{n \bar{y}} \times 100\% = 9.00\%$

(9) Standard deviation $\rightarrow s = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}} = 1.394$

(10) Relative standard deviation $\rightarrow \frac{s}{\bar{x}} \times 100\% = 12.23\%$

* Conclusions $\rightarrow$

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

* Questions ⇒ P (1a)

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groups	Homogeneous	non-homogeneous
mean	11.06	11.4
S.D	0.3209	1.394
R.S.D	2.9%	12.23%

2] Homogeneous →

$$MV_{NaOH} = MV_{CH_3COOH}$$

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

$$\Rightarrow M_{CH_3COOH} = 0.1106 M$$

non-homogeneous →

$$MV_{NaOH} = MV_{CH_3COOH}$$

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

$$\Rightarrow M_{CH_3COOH} = 0.114 M$$

3] Homogeneous →

$$\frac{x_1 - x_r}{x_r} \times 100\%$$

$$\Rightarrow \frac{0.1106 - 0.1}{0.1} \times 100\%$$

$$= 10.6\%$$

more accurate and precise

non-homogeneous →

$$\frac{x_1 - x_r}{x_r} \times 100\%$$

$$\Rightarrow \frac{0.114 - 0.1}{0.1} \times 100\%$$

$$= 14.0\%$$

which is more accurate and precise ??
(1)

* Questions ⇒ (clearing)

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 abedellhakim alKhaubrah

*Reg. No. : 0201324

*locker No. : 307

*Sec : 9

*Instructor: Dr. Mohammed Amer.

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

10
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Experiment 3 Date Sheet and Calculations

Name: فايزة النور
Reg. No.: 0201324

Section: 9
Date:

Mass of Na_2CO_3	<u>0.5023 ± 0.0001 g</u>	
(A) Vol. of Na_2CO_3	Vol. of HCl	
1. <u>10.0 ± 0.05 mL</u>	<u>11.5</u>	<u>± 0.07 mL</u>
2. <u>10.0 ± 0.05 mL</u>	<u>11.5</u>	<u>± 0.07 mL</u>
3.		
(B) Vol. of NaOH	Vol. of HCl	
1. <u>10.0 ± 0.05 mL</u>	<u>12.5</u>	<u>± 0.07 mL</u>
2. <u>10.0 ± 0.05 mL</u>	<u>12.8</u>	<u>± 0.07 mL</u>
3.		
(C) Vol. of H_3PO_4	Vol. of NaOH	Indicator
1. <u>10.0 ± 0.05</u>	<u>12.3 ± 0.07</u>	<u>bromocr</u>
2. <u>10.0 ± 0.05</u>	<u>19.4 ± 0.07</u>	<u>phenolph.</u>

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: [Signature]

Instructor's name: [Signature]

30/3/2027

Wed

* Purpose :-

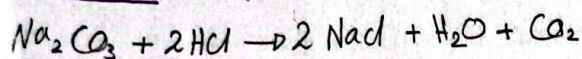
Prepare and standardize one solution of an acid and one of a base, and the use of the standardized basic solution to analyze unknown commercial phosphoric acidic solution, in which different indicators are going to be used.

* 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 :-

part "A" $\rightarrow$ (M Na_2CO_3 & HCl)



$$\checkmark \text{ mass } Na_2CO_3 = 0.5023 \pm 0.0001 \text{ g}$$

$$\checkmark M_w Na_2CO_3 = 105.8 \text{ g/mol}$$

$$\hookrightarrow \text{moles of } Na_2CO_3 = \frac{\text{mass}}{M_w} = \frac{0.5023}{105.8} = 4.747 \times 10^{-3} \text{ mol}$$

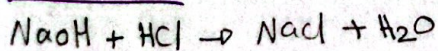
$$\Rightarrow M(Na_2CO_3) = \frac{\text{mole}}{V(L)} = \frac{4.747 \times 10^{-3}}{100.0 \times 10^{-3}} = 0.04747 \text{ M } Na_2CO_3$$

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

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

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

part "B" $\rightarrow$ (M NaOH)



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

$$\hookrightarrow (MV)_{NaOH} = (MV)_{HCl}$$

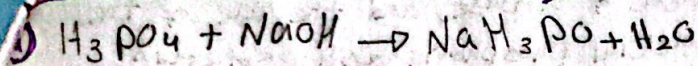
$$M_{(NaOH)} = \frac{(0.0825)(12.6)}{10.00} = 0.103 \text{ M NaOH}$$

$$\checkmark \text{ uncertainty of the balance } \Rightarrow \pm 0.0001$$

$$\checkmark \text{ uncertainty } \Rightarrow \frac{1}{2} \times 0.1 = \pm 0.05$$

$$\checkmark \text{ uncertainty } \Rightarrow \sqrt{(0.05)^2 + (0.05)^2} = \pm 0.07$$

part 'c' → (unknown 70) 70



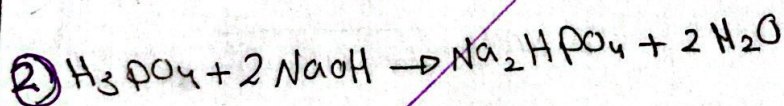
Indicator: Bromocresol green.

$$\Rightarrow (MV)_{\text{H}_3\text{PO}_4} = (MV)_{\text{NaOH}}$$

$$M_{\text{H}_3\text{PO}_4} = \frac{(0.103)(12.3)}{10.00} = 0.126 \text{ M} \rightarrow \frac{\text{mol}}{\text{L}}$$

$$M_w(\text{H}_3\text{PO}_4) = 97.9 \text{ g/mol}$$

$$\Rightarrow 0.126 \frac{\text{mol}}{\text{L}} \times 97.9 \frac{\text{g}}{\text{mol}} = 12.4 \text{ g/L}$$



Indicator: phenolphthalein.

$$\Rightarrow (MV)_{\text{H}_3\text{PO}_4} = \frac{1}{2} (MV)_{\text{NaOH}}$$

$$M_{\text{H}_3\text{PO}_4} = \frac{1}{2} \frac{(0.103)(19.4)}{10.00} = 0.099 \text{ M} \rightarrow \frac{\text{mol}}{\text{L}}$$

$$M_w(\text{H}_3\text{PO}_4) = 97.9 \text{ g/mol}$$

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

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



* Conclusions:-

A. we have 3 kinds of titration:

- 1) strong acid-weak base: $\text{HCl} - \text{Na}_2\text{CO}_3$
- 2) strong acid-strong base: $\text{HCl} - \text{NaOH}$
- 3) strong base-weak acid: $\text{NaOH} - \text{H}_3\text{PO}_4$

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

C) Na_2CO_3 is a primary standard.

* Questions (clearing):-

1) equivalence: at which 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)

$$\frac{1}{2}(MV)_{\text{HCl}} = (MV)_{\text{Na}_2\text{CO}_3}$$

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

$$M = 0.08 \text{ M HCl}$$

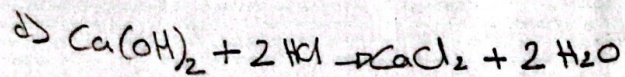


Question (P. 24):-

1) Steps:-

- prepare a standard solution for Ca(OH)_2
- allow the undissolved Ca(OH)_2 to settle down the saturated solution.

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



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

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

2) Steps:-

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

b) Add suitable indicator and titrate with suitable acid

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

d) calculate the mass of $\text{H}_2\text{O} = \text{mass of } \text{Na}_2\text{CO}_3 \cdot X \text{H}_2\text{O} - \text{mass of } \text{Na}_2\text{CO}_3$.

e) calculate moles of H_2O (from molar mass)

$$\text{f) } X = \text{moles of } \text{H}_2\text{O} / \text{moles of } \text{Na}_2\text{CO}_3$$

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 equivalence point.



practical Analytical chemistry.

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* Reg. No.: 0201324

* locker No.: 307

* Date: 6/4/2022

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

* Sec. No.: 9

* Instructor: Dr. mohammed amr

8/10



xi

Section: 9
Date:

Mass of NaCl: ...0.6074...0.0...		
(A) Mohr's method	Trial (1)	Trial (2)
Vol. of NaCl solution	10.0 ± 0.05	10.00 ± 0.05
Vol. of AgNO ₃ solution	9.70 ± 0.07	10.90 ± 0.07
(B) Fajan's method		
Vol. of NaCl solution	10.00 ± 0.07	
Vol. of AgNO ₃ solution	12.70 ± 0.07	
(C) Volhard's method		
Vol. of AgNO ₃ solution	10.0 ± 0.05	10.60 ± 0.05
Vol. of KSCN solution	11.10 ± 0.07	11.40 ± 0.07

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

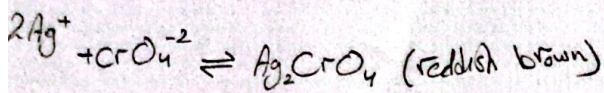
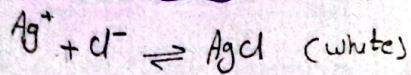
Instructor's Name:

6/4/2022

Week

* Calculation $\Rightarrow$

(A) Mohr's method $\Rightarrow$



$$\rightarrow \bar{V}_{\text{AgNO}_3} = (9.70 + 10.9)/2 = 10.3 \text{ mL}$$

$$\rightarrow \text{wt of NaCl} = 0.6072 \pm 0.0001 \text{ g}$$

$$\rightarrow \text{Mw of NaCl} = 58.5$$

$$\rightarrow \text{Volume of NaCl} = 100 \text{ mL}$$

$$\rightarrow n_{(\text{NaCl})} = \frac{m}{M_w} = \frac{0.6072 \text{ g}}{58.5 \text{ (g/mol)}} = 0.0103 \text{ mol}$$

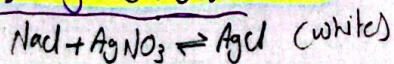
$$\rightarrow M_{(\text{NaCl})} = \frac{n}{V} = \frac{0.0103 \text{ mol}}{100 \times 10^{-3} \text{ L}} = 0.103 \text{ mol/L}$$

$$\Rightarrow M V_{(\text{NaCl})} = M V_{(\text{AgNO}_3)}$$

$$(0.103) \times (10.0) = M (10.3) \rightarrow M_{(\text{AgNO}_3)} = \underline{\underline{0.1 \text{ M}_{(\text{AgNO}_3)}}}$$

$$\hookrightarrow 0.1 \frac{\text{mol}}{\text{L}} \times \frac{169.8 \text{ g}}{\text{mol}} = \underline{\underline{16.98 \text{ g/L}_{(\text{AgNO}_3)}}}$$

(b) Fajan's method $\Rightarrow$



$$\rightarrow V_{(\text{AgNO}_3)} = 12.7 \text{ mL}, n_{(\text{NaCl})} = 0.0103 \text{ mol}, M_{(\text{NaCl})} = 0.103 \text{ M}$$

$$\Rightarrow M V_{(\text{NaCl})} = M V_{(\text{AgNO}_3)}$$

$$(0.103) (10.0) = M (12.7) \rightarrow M_{(\text{AgNO}_3)} = \underline{\underline{0.0811 \text{ M}_{(\text{AgNO}_3)}}}$$

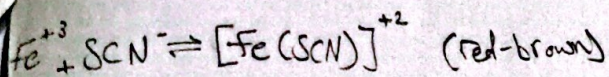
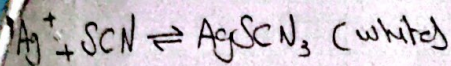
$$\hookrightarrow 0.0811 \frac{\text{mol}}{\text{L}} \times \frac{169.8 \text{ g}}{\text{mol}} = \underline{\underline{13.77 \text{ g/L}_{(\text{AgNO}_3)}}}$$

* The mean values of Both methods $\Rightarrow$

$$\hookrightarrow \text{For molarity}_{(\text{AgNO}_3)} = ((0.1) + (0.0811))/2 = \underline{\underline{0.09055 \text{ M}}}$$

$$\hookrightarrow \text{For g/L}_{(\text{AgNO}_3)} = ((16.98) + (13.77))/2 = \underline{\underline{15.375 \text{ g/L}}}$$

Volhard's method $\Rightarrow$



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

$$\rightarrow \bar{M}(\text{AgNO}_3) = 0.09055 \text{ M (AgNO}_3)$$

$$\Rightarrow M V_{(\text{AgNO}_3)} = M V_{(\text{KSCN})}$$

$$(0.09055)(10.0) = M(11.25) \rightarrow M_{(\text{KSCN})} = 0.0804 \text{ M (KSCN)}$$

$$\rightarrow 0.0804 \frac{\text{mol}}{\text{L}} \times \frac{97.19}{\text{mol}} = 7.80684 \text{ g/L}$$

(D) I. According to Mohr's method $\Rightarrow$

$$\rightarrow \bar{V}(\text{AgNO}_3) = ((11.5) + (10.3)) / 2 = 10.9 \text{ mL}$$

$$\rightarrow n_{(\text{AgNO}_3)} = M \cdot \bar{V} = (0.09055) \times (10.9 \times 10^{-3}) = 9.86 \times 10^{-4}$$

$$\rightarrow \text{wt of the mixture } (X + Y = 0.065 \text{ g}), \quad X = 0.065 - Y$$

$$\text{mol}(\text{NaCl}) + \text{mol}(\text{KCl}) = \text{mol}(\text{AgNO}_3)$$

$$\frac{X}{M_{w, \text{NaCl}}} + \frac{Y}{M_{w, \text{KCl}}} = 9.86 \times 10^{-4}$$

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

$$\rightarrow Y = 0.03408 \text{ g}, \Rightarrow X = 0.03092 \text{ g}$$

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

$$= 3.408 \text{ g/L (KCl)}$$

$$\checkmark \frac{\text{mass}(\text{NaCl})}{V(\text{L})} = \frac{0.03092 \text{ g}}{10.0 \times 10^{-3} \text{ L}}$$

$$= 3.092 \text{ g/L (NaCl)}$$

$$X + Y = 0.065 \text{ g}$$

$$X \rightarrow \text{g (NaCl)}$$

$$Y \rightarrow \text{g (KCl)}$$

$$\frac{X}{58.5} + \frac{Y}{74.5} = (M V) \text{ for } \text{Ag}^+$$

(-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 CrO_3^{2-} will be formed which means that active errors will occur so the neutral media is the best media.
- 2) Because in Fajans method we use fluorescein indicator which in acidic media solution will react with H^+ from the acid to form (HFl), 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 becomes pink) so we will have positive error.
- 3) $K_{sp}(\text{Ag}_2\text{Cr}_2\text{O}_7) > K_{sp}(\text{K}_2\text{CrO}_4)$, so it is more soluble, so reaching 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 because of the reaction of Ag^+ with OH^- from the base (in Mohr's & Fajans method), so $\text{AgOH} \rightarrow \text{Ag}_2\text{O}_{(\text{ppt})}$ very large positive error.
but in Volhard's method Fe^{3+} will react with OH^- to form $\text{Fe}(\text{OH})_3$
 $\rightarrow \text{Fe}(\text{OH})_3 \rightarrow \text{Fe}_2\text{O}_3$ so we need more Ag^+ so positive error.
- 5) Because nitro benzene is added in case of titration of Cl^- by the Volhard's method reaction such as $\text{AgCl} + \text{SCN}^- \rightarrow \text{AgSCN} + \text{Cl}^-$.
 AgCl is more soluble than AgSCN
 $K_{sp} \text{ AgCl} > K_{sp} \text{ AgSCN}$.



practical Analytical chemistry

*Name: Renad abdelhakim

*Reg. No. :- 0201324

*Locker No. :- 307

*Section :- 9

*Instructor :- Dr. Mohammed Amer.

*Date :- 13/4/2022

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

($\frac{4}{10}$ $\times 1$)



Experiment 5 Data Sheet and Calculations

Name: *Rexad abedalkakim*
Reg. No.: *0201324*

Section: *9*
Date: *6/4/2022*

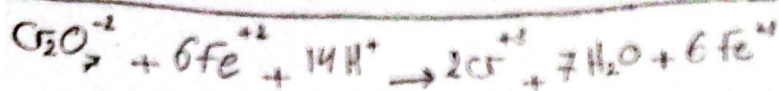
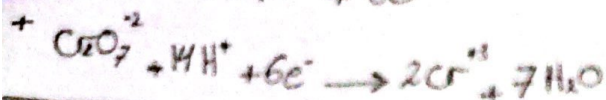
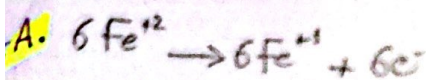
Unknown ID No.: <i>5</i>	
(A) Determination of Fe^{2+} in a mixture	
Vol. of unknown solution ± 0.05	Vol. of $\text{K}_2\text{Cr}_2\text{O}_7 \pm 0.07$
1) <i>10.00 ± 0.05</i>	<i>5.30 ± 0.07 4.90 ± 0.07</i>
2) <i>10.00 ± 0.05</i>	<i>4.30 ± 0.07</i>
3)	
(B) Determination of Fe^{3+} after reduction	
Vol. of unknown solution	Vol. of $\text{K}_2\text{Cr}_2\text{O}_7 \pm 0.07$
1) <i>10.00 ± 0.05</i>	<i>5.20 ± 0.07</i>
2) <i>10.00 ± 0.05</i>	<i>4.80 ± 0.07</i>

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

Instructor's signature: *[Signature]*

Instructor's Name:

calculations:-



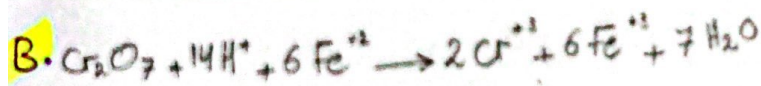
$\rightarrow \bar{V}(\text{Cr}_2\text{O}_7^{2-}) = (4.90 + 4.30)/2 = 4.60$

$\rightarrow n(\text{Cr}_2\text{O}_7^{2-}) \Rightarrow M \times V \rightarrow (0.02) \times (460 \times 10^{-3}) = 9.2 \times 10^{-3} \text{ mol}(\text{Cr}_2\text{O}_7^{2-})$

$\rightarrow n(\text{Fe}^{+2}) \rightarrow 1 \text{ mol}(\text{Cr}_2\text{O}_7^{2-}) \rightarrow 6 \text{ mol}(\text{Fe}^{+2}) \Rightarrow 5.52 \times 10^{-3} \text{ mol}(\text{Fe}^{+2})$
 $9.2 \times 10^{-3}(\text{Cr}_2\text{O}_7^{2-}) \rightarrow ? \text{ mol}(\text{Fe}^{+2})$

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

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



$\rightarrow \bar{V}(\text{Cr}_2\text{O}_7^{2-}) = 5.00 \text{ mL}$

$\rightarrow n(\text{Cr}_2\text{O}_7^{2-}) = M \times V = 0.02 \times 5.00 \times 10^{-3} = 1.0 \times 10^{-4} \text{ mol}(\text{Cr}_2\text{O}_7^{2-})$

$\rightarrow n(\text{Fe}^{+2}) = 1 \text{ mol}(\text{Cr}_2\text{O}_7^{2-}) \rightarrow 6 \text{ mol}(\text{Fe}^{+2}) \Rightarrow 6 \times 10^{-4} \text{ mol}(\text{Fe}^{+2})$
 $1.0 \times 10^{-4}(\text{Cr}_2\text{O}_7^{2-}) \rightarrow ? \text{ mol}(\text{Fe}^{+2})$

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

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

$\Rightarrow \text{Fe}^{+3}(\text{g/L}) = \text{Fe}_e^{+2} - \text{Fe}_A^{+2} = (3.34) - (3.08)$
 $= 0.268 \text{ g/L}$



* 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 endpoint easily and also it has lower pointed difference.

2) yes, because iron contains Fe_2O_3 and Fe_3O_4 which can be dissolved in acidic solution to get $\text{Fe}^{+3} \rightarrow \text{Fe}^{+2}$ by Jones reductor then with CrO_7^{2-} using H_3PO_4 and diphenolic sulfuric acid indicator.

3) after making a solution of zinc amalgam, we add the unknown mixture with H_2SO_4 and boil them until the yellow color disappears, this confirms that all Fe^{+3} to Fe^{+2} to check the complete reduction of Fe^{+3} one drop of the solution is added to form that means we have complete reduction of Fe^{+3} to Fe^{+2} .



practical Analytical chemistry

*Name: Renad abed alhakim

*Reg. No: 0201324

*locker No: 307

*Sec: 9, Dr. Mohamed Amer

*Date: 27/4/2022

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



Experiment 6 Data Sheet and Calculations

Name: Renad abdelhakim
Reg. No.: 0201324

Section: 9
Date: 27/4/2022

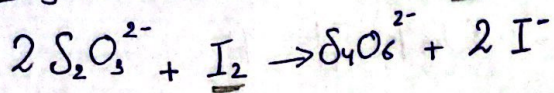
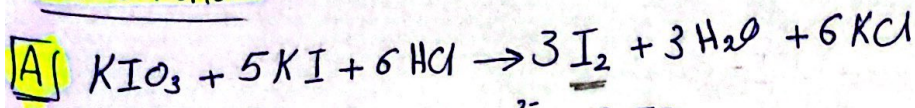
(A) Standardization of 0.1M thiosulfate			
Wt of $\text{KIO}_3 = 0.4190$		g ± 0.0001	
Volume of $\text{KIO}_3 \pm 0.05$		Volume of $\text{Na}_2\text{S}_2\text{O}_3 \pm 0.07$	
1-	$10.00 \pm$ ml	$12.8 \pm$	ml
2-	$10.00 \pm$ ml	$12.5 \pm$	ml
3-			ml
(B) Standardization of 0.1M iodine:			
Volume of $\text{I}_2 \pm 0.05$		Volume of $\text{Na}_2\text{S}_2\text{O}_3 \pm 0.07$	
1-	$10.00 \pm$ ml	$26.2 \pm$	ml
2-	$10.00 \pm$ ml	$27.4 \pm$	ml
3-			ml
(C) Determination of tin in the unknown:			
Unknown ID #: <u>(9)</u>			
Volume of I_2 ± 0.05	volume the unknown solution ± 0.05	Volume of $\text{Na}_2\text{S}_2\text{O}_3 \pm 0.07$	
1-	$15.00 \pm$ ml	$10.00 \pm$ ml	ml $25.2 \pm$
2-	$15.00 \pm$ ml	$10.00 \pm$ ml	ml $22.3 \pm$
3-			ml

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

27.4.2022



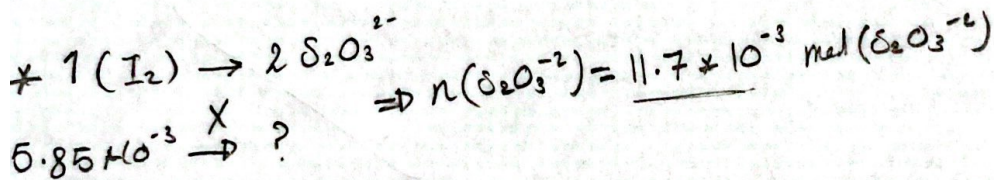
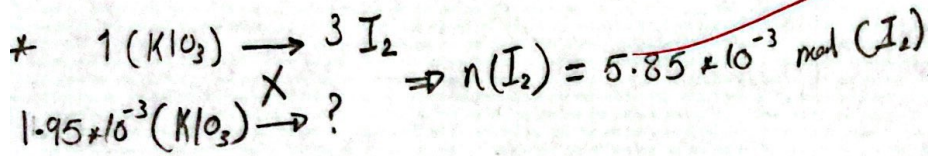
* calculation :-



$\rightarrow (\text{V}) \text{KIO}_3 = 10.00 \text{ mL}, \text{wt. KIO}_3 = 0.4190 \text{ g}, \text{Mw. KIO}_3 = 214 \text{ g/mol}$

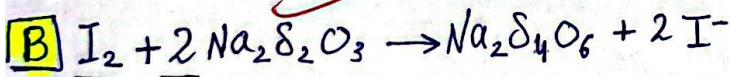
$\rightarrow (\text{V}) \text{Na}_2\text{S}_2\text{O}_3 = 12.65 \text{ mL}, \text{Mw. Na}_2\text{S}_2\text{O}_3 = 158 \text{ g/mol}$

* $n(\text{KIO}_3) = 1.95 \times 10^{-3} \text{ mol (KIO}_3) \rightarrow M(\text{KIO}_3) = \frac{1.95 \times 10^{-3}}{100 \times 10^{-3}} = 0.0195 \text{ M (KIO}_3)$



$\therefore \text{So: } n(\text{KIO}_3) = \frac{n(\text{S}_2\text{O}_3^{2-})}{6} \rightarrow MV_{\text{KIO}_3} = MV_{\text{S}_2\text{O}_3^{2-}} \Rightarrow M_{\text{S}_2\text{O}_3^{2-}} = \frac{(0.0195)(10 \times 10^{-3})(6)}{12.65 \times 10^{-3}}$

$\therefore M_{\text{S}_2\text{O}_3^{2-}} = 0.0924 \text{ M (S}_2\text{O}_3^{2-}) \rightarrow 0.0924 \frac{\text{mol}}{\text{L}} \times 158 \frac{\text{g}}{\text{mol}} = 14.6 \text{ g/L}$



$\rightarrow (\text{V}) \text{I}_2 = 10.00 \text{ mL}, \text{Mw. I}_2 = 253 \text{ g/mol}$

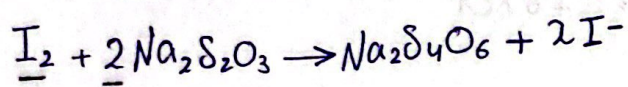
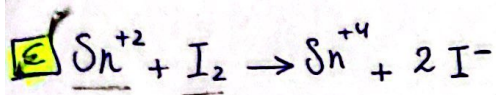
$\rightarrow (\text{V}) \text{Na}_2\text{S}_2\text{O}_3 = 26.8 \text{ mL}$

* $n_{\text{I}_2} = \frac{n_{\text{S}_2\text{O}_3^{2-}}}{2} \rightarrow MV_{\text{I}_2} = \frac{MV_{\text{S}_2\text{O}_3^{2-}}}{2} \Rightarrow M_{\text{I}_2} = \frac{(0.0924)(26.8)}{(2)(10)} = 0.123 \text{ M (I}_2)$

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

0.5





Unk # 9

$$\rightarrow (V) \text{I}_2 = 15.00 \text{ mL}$$

$$\rightarrow (V) \text{unknown} = 10.00 \text{ mL}, \text{ Mw Sn}^{+2} = 118.7 \text{ g/mol}$$

$$\rightarrow (V) \text{S}_2\text{O}_3^{2-} = 23.75 \text{ mL}$$

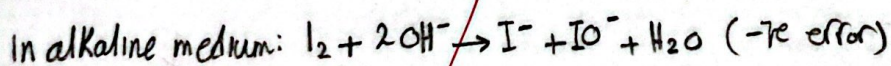
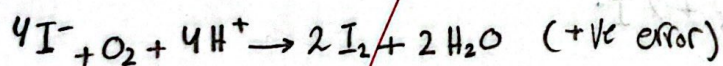
$$* n_{\text{I}_2} = n_{\text{Sn}^{+2}}, \rightarrow n_{\text{Sn}^{+2}} = n_{\text{I (total)}} - n_{\text{I (react with S}_2\text{O}_4^{2-})} \rightarrow \frac{MV_{\text{I}_2}}{2} - \frac{MV_{\text{S}_2\text{O}_3^{2-}}}{2} = MV_{\text{Sn}}$$

$$\rightarrow \frac{(0.123)(15) - (0.0924)(23.75)}{2} = M(10) \Rightarrow \boxed{M = 0.074 \text{ M Sn}^{+2}}$$

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

* Question $\Rightarrow$ p. 40

1) In acidic medium air oxidize I^- and a hydrolysis of starch occurs:



2) To be sure there are no bacteria or air that may oxidize $\text{Na}_2\text{S}_2\text{O}_3$.

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

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

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



practical Analytical chemistry

* Name: Renad abedalkhaki

* 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 abdelhakim

Section: 9

Reg. No.: 0201324

Date: 11/5/2022

(A) Standardization of EDTA

Mass of $ZnSO_4 \cdot 7H_2O$	$0.3408 \pm 0.0001 g$			
Data	Trial 1	Trial 2	Trial 3	Average
Volume of $ZnSO_4 \cdot 7H_2O$ 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		± 0.5	
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) ± 0.07 (corresponding to Ca)	8.3			

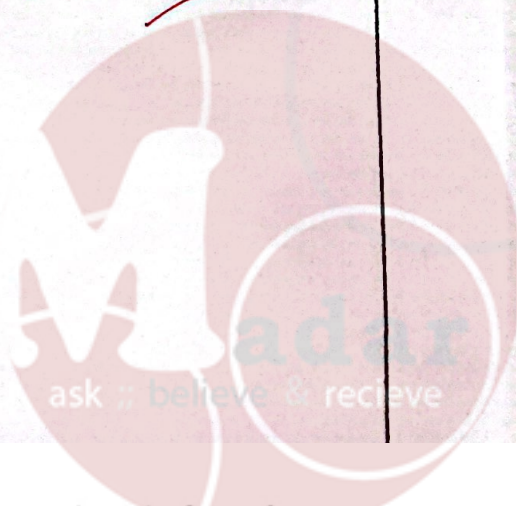


Data	Trial 1	Trial 2	Trial 3	Average
Volume of EDTA corresponding to Mg ($V_1 - V_2$) ± 0.07	7.3			
ppm Ca	38.7			
ppm Mg	20.6			
Water hardness (mg CaCO_3/L)	181.4			
(C) Unknown solution 44				
Unknown ID No.				
Data	Trial 1	Trial 2	Trial 3	Average
1. Vol. of unknown solution ± 0.05	10 mL	10 mL		
2. Vol. of EDTA solution ± 0.07	36.5	37.2		
3. ppm Ca and Mg				
4. Vol. of unknown solution ± 0.05	10 mL	10 mL		
5. Vol. of EDTA solution ± 0.07	28.7	29.2		
6. ppm Ca				

Instructor's Signature:

Instructor's Name: M. S. K. V.

11/5/2022 mol



* Calculation 8-

A). $ZnSO_4 \cdot 7H_2O$ $\left\{ \begin{array}{l} \text{mass} = 0.3408 \text{ g} \\ M_w = 287 \text{ g/mol} \end{array} \right. \rightarrow n = 1.187 \times 10^{-3} \text{ mol}, M = \frac{1.187 \times 10^{-3}}{100 \times 10^{-3}} = 0.011 \text{ M}$

• $V_{EDTA} = 18.9 \text{ mL}$

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

$(0.011)(10) = (M)(18.9) \Rightarrow M = 5.82 \times 10^{-3} \text{ M (EDTA)}$

B) a) $V_{\text{water}} = 50 \text{ mL}, V_{EDTA(Ca)} = 15.60 \text{ mL}, V_{EDTA(Mg)} = 8.3 \text{ mL}$ $\left\{ \begin{array}{l} M_w_{Ca} = 40.1 \text{ g/mol} \\ M_w_{Mg} = 24.3 \text{ g/mol} \end{array} \right.$

$\Rightarrow V_{EDTA(V_1 - V_2)} = 7.3 \text{ mL}$

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

$(5.82 \times 10^{-3})(8.3) = M(50) \Rightarrow M = 9.661 \times 10^{-4} \text{ M (Ca)}$

$\hookrightarrow \text{in ppm} = M_{Ca} \times M_w_{Ca} \times 1000 = 38.7 \text{ (ppm)} \rightarrow Ca$

$\rightarrow n_{EDTA(V_1)} = M \times V_1 = (5.82 \times 10^{-3})(15.6 \times 10^{-3}) = 9.07 \times 10^{-5} \text{ mol}$

$\rightarrow n_{EDTA(V_2)} = M \times V_2 = (5.82 \times 10^{-3})(8.3 \times 10^{-3}) = 4.83 \times 10^{-5} \text{ mol}$

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

$\hookrightarrow \text{in ppm} = M_{Mg} \times M_w_{Mg} \times 1000 = 20.6 \text{ ppm} \rightarrow Mg$

b) water hardness $\rightarrow$

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

$(9.07 \times 10^{-5}) = M \times 50 \times 10^{-3} \Rightarrow M = 1.814 \times 10^{-3} \text{ M}, M_w(CaCO_3) = 100 \text{ g/mol}$

$\hookrightarrow \text{in ppm} = 181.4 \text{ ppm}$
 $\hookrightarrow \text{mg/L}$

Ex. $V_{\text{unknown}} = 10 \text{ mL}$, $\overline{V}_{\text{EDTA}} = 36.85 \text{ mL}$, $\overline{V}_{\text{EDTA}_a} = 28.95 \text{ mL}$

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

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

$$\rightarrow MV_{\text{EDTA}} = MV_{\text{unkn}}$$

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

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

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

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

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



Name: Renad abedalhakim

Reg. No: 0201324

Locker No: 307

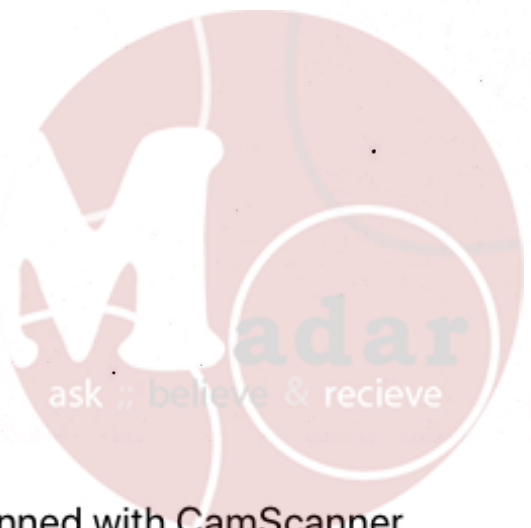
sec: 9

Date: 20/4/2022

(10)

Instructor: Dr. Mohammed Amer

Exp: Determination of calcium by quantitative precipitation (8)



Experiment 8 Data Sheet and Calculations

Name: *Rewa abdalla*

Section: 9

Reg. No.: *201324*

Date: *20/4/2022*

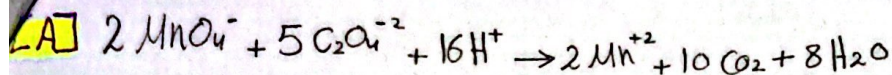
Unknown ID No.:	
(A) Standardization of KMnO_4	
Mass of Sodium oxalate <i>0.6030 ± 0.0001</i> g per 100 mL	
Molarity of sodium oxalate	
Vol. of $\text{Na}_2\text{C}_2\text{O}_4$ solution	Vol. of KMnO_4
1) <i>10.00 ± 0.05</i>	<i>9.05 ± 0.07</i>
2) <i>10.00 ± 0.05</i>	<i>9.00 ± 0.07</i>
3) <i>10.00 ± 0.05</i>	<i>8.90 ± 0.07</i>
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) <i>10.00 ± 0.05</i>	<i>29.90 ± 0.07</i>
2)	
3)	
Concentration of Ca^{2+} solution in g/L	

Instructor's Signature:

Instructor's Name:



Calculation:



$\rightarrow \text{wt. } \text{C}_2\text{O}_4^{2-} = 0.6030 \text{ g} + 0.0001$

$\rightarrow \text{Mw } \text{Na}_2\text{C}_2\text{O}_4 = 134 \text{ g/mol}$

$\rightarrow \text{Mw } \text{KMnO}_4 = 158 \text{ g/mol}$

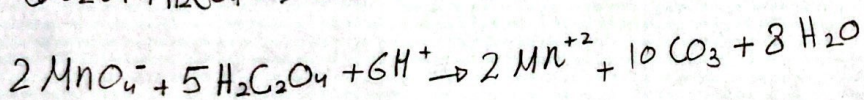
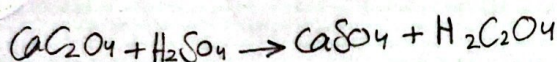
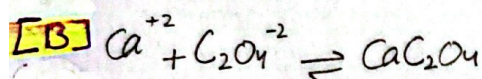
$\rightarrow \bar{V} (\text{KMnO}_4) = 8.98 \text{ mL}$

$\rightarrow n (\text{Na}_2\text{C}_2\text{O}_4) = \frac{0.6030}{134} = 4.5 \times 10^{-3} \text{ mol} \Rightarrow M (\text{Na}_2\text{C}_2\text{O}_4) = \frac{4.5 \times 10^{-3}}{100 \times 10^{-3}} = 0.045 \text{ M } (\text{Na}_2\text{C}_2\text{O}_4)$

$\rightarrow M (\text{KMnO}_4) \Rightarrow \frac{(M_1 V_1)_{\text{KMnO}_4}}{2} = \frac{(M_2 V_2)_{\text{Na}_2\text{C}_2\text{O}_4}}{5}$

$= \frac{(M_1 (8.98))}{2} = \frac{(0.045)(10)}{5} \Rightarrow M_{\text{KMnO}_4} = 0.020 \text{ M } (\text{KMnO}_4)$

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



$\rightarrow \text{Mw } (\text{Ca}^{2+}) = 40 \text{ g/mol}$

$\rightarrow V (\text{KMnO}_4) = 29.90 \text{ mL}$

$\rightarrow V (\text{Ca}^{2+}) = 10.00 \text{ mL}$

$\rightarrow \frac{MV (\text{Ca}^{2+})}{5} = \frac{MV (\text{KMnO}_4)}{2}$

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

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



* 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 $\text{C}_2\text{O}_4^{2-}$ 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 albed alhakim

Reg.No: 0201324

Laker No.: 307

Sec.No: 9

Instructor: Mohammad Amer.

Date: 23/3/2022

Exp: Gravimetric determination of sulfate. (9)

~~9.5~~
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 $\Rightarrow$

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

$\hookrightarrow$ main observation $\rightarrow$ change the color

* Calculations $\Rightarrow$

* Mass of precipitate (BaSO_4) = (mass of crucible + precipitate) - (mass of crucible)

$$\hookrightarrow 17.3425 - 16.7334 = \boxed{0.6091 \text{ g}}$$

$$\hookrightarrow \text{uncertainty} \rightarrow \sqrt{(0.0001)^2 + (0.0001)^2} = \boxed{\pm 0.0001}$$

$$* F_w \text{SO}_4 = (1 \times 32.06) + (4 \times 16) = \boxed{96.06 \text{ g/mol}}$$

$$* F_w \text{BaSO}_4 = (1 \times 137.33) + (1 \times 32.06) + (4 \times 16) = \boxed{233.39 \text{ g/mol}}$$

$$* \text{mass of } \text{SO}_4^{2-} = \text{weight of BaSO}_4 \times \frac{F_w \text{SO}_4}{F_w \text{BaSO}_4}$$

$$\hookrightarrow 0.6091 \times \frac{96.06}{233.39} = \boxed{0.251 \text{ g}}$$

in part A $\hookrightarrow$

Volume of unknown = $10.00 \text{ mL} \pm 0.05$ (using a pipet)

$\hookrightarrow$ concentration of sulfate in $\text{mg/L} \rightarrow$

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

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

$$M = \frac{m(\text{mg})}{V(L)} = \frac{0.251 \times 10^3}{10 \times 10^{-3}}$$

$$= \boxed{2.51 \times 10^4 \text{ mg/L}}$$

$2.51 \times 10^4 = 25010 \text{ mg/L}$
 25010 mg/L

* Questions $\Rightarrow$ P(64)

1) to prevent co-precipitate of Ba^{2+}

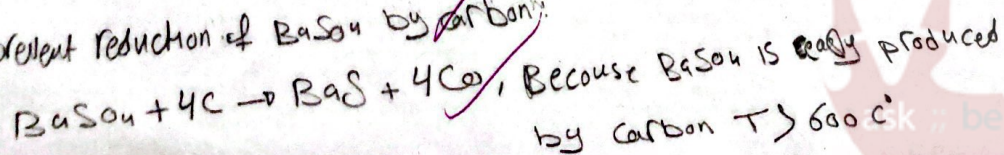
B) Force precipitate to form larger crystals and so making filtration easier
C) prevent any crystals passing with filtrate throw the filter paper

2) to prevent inclusion and occlusion

D) Ensure that only BaSO_4 precipitate.

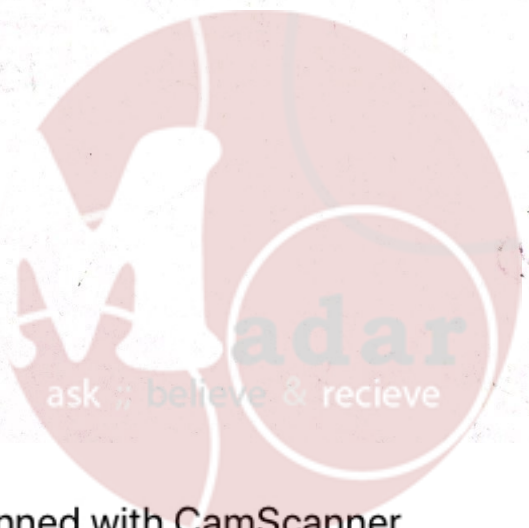
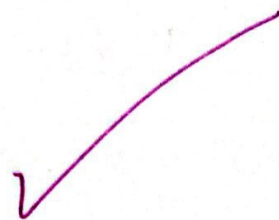
3) to prevent coprecipitation

4) to prevent reduction of BaSO_4 by carbon:



* conclusion:-

- ✓ All readings were close to their averages, so there was high precision
- ✓ There were some losses 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 $\pm$ 0.05 mL
Mass of empty crucible	303.890 $\pm$ 0.0001 g
Mass of empty crucible + Ni(DMG) ₂	305.462 $\pm$ 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 $\times 10^4$ mg/L

9.5/10

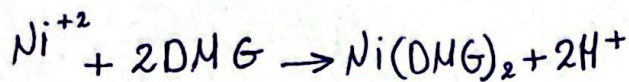
2.8

Instructor's Signature:

Instructor's Name:



*Calculation:-



$$\rightarrow \text{Vol of } \text{Ni}^{+2} = 10.00 \text{ mL}$$

$$\rightarrow \text{Mass } \text{Ni}(\text{DMG})_2 = 1.572 \text{ g}$$

$$\rightarrow \text{Mw } \text{Ni}(\text{DMG})_2 = 286.76 \text{ g/mol} / \text{Mw Ni} = 58.76 \text{ g/mol}$$

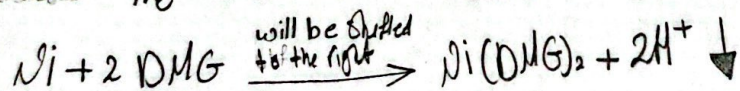
$$\therefore m_{\text{Ni}^{+2}} = m_{\text{Ni}(\text{DMG})_2} \times \frac{\text{Mw Ni}}{\text{Mw Ni}(\text{DMG})_2} \rightarrow n(\text{Ni})$$

$$= 1.572 \times \frac{58.76}{286.76} = \underline{\underline{0.3221 \text{ g}}}$$

$$\therefore \text{Concentration } \text{Ni}^{+2} (\text{mg/L}) = \frac{0.3221}{10 \times 10^{-3}} \times 1000 = 3221.8 \text{ mg/L} = \underline{\underline{3.221 \times 10^4 \text{ mg/L}}}$$

*Question:-

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



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

3. By washing the precipitate with warm distilled 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.

