Analytical lab

First semester 2025-2026 reports

Done by: مجد الزعبي

Madar Team

practical Analytical Chemistry

10/10

Name :- Majd emad Al-zoubi

Reg. No :- 0222387

Locker. No :- 163

Section Nb :- 9

Instructor :- Dr. Mohammad Rashid

course. No :- 0303216

Date of exp :- 14-10-25

Title of exp :- Volumetric Glassware and Balaces

Date of delivery Reports :- 21-10-25

Exp. No : (1)

0.05

Experiment 1

Data sheet and calculations

Name: Majd emad Al-zoubi
Reg. No.: 0222387
Section: 9
Date: 14/10/2025

	Trial (1)	Trial (2)	Trial (3)
Initial burette reading	0.10 ±0.05	4.80 ±0.05	9.80 ±0.05
Final burette reading	4.80 ±0.05	9.80 ±0.05	14.90 ±0.05
Apparent volume, ml	4.70±0.07	5.00± 0.07	5.1 ±0.07
Weight of empty flask	6.7476g ±0.0001	6.6477g ±0.0001	6.6477g ±0.0001
Weight of flask and water	11.0600g ±0.0001	11.6419 g ±0.0001	11.5986g ±0.0001
Weight of water, g	4.3124g ±0.0001	4.9942g ±0.0001	4.9509g ±0.0001
Temperature, °C	24.0 ±0.5	24.0 ±0.5	24.0 ±0.5
Actual (experimental) volume, ml	4.3279mL	5.0122mL	4.9687
Correction (ml)	-0.37 mL	0.01 mL	-0.13 mL

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

Instructor's Signature:

fatema abdullah

Instructor's Name:

14/10/2025

Calculations :-

1 Apparent volume [mL] = Final burette reading - Intial burette reading

→ Trial (1) :- $4.80 - 0.10^{\pm 0.05} = 4.70\text{ mL} \pm 0.07$

→ Trial (2) :- $9.80 - 4.80 = 5.00\text{ mL} \pm 0.07$

→ Trial (3) :- $14.90 - 9.80 = 5.10\text{ mL} \pm 0.07$

$\sqrt{(0.05)^2 (0.05)^2}$

* Uncertainty :- For the balance → ±0.0001

For the burette → 1/2 * least divesion = 1/2 * 0.1 = 0.05 → (±0.05) (intial & final read)

For the burette → $\sqrt{(\text{uncertainty})^2 + (\text{uncertainty})^2} = \sqrt{(0.05)^2 + (0.05)^2} = \pm 0.07$

For the Thermometer → 1/2 * least divesion = 1/2 * 1 = ±0.5

For the weight of water → $\sqrt{(0.0001)^2 + (0.0001)^2} = \pm 0.0001$

2 weight of water [g] = weight of flask and water - weight of empty flask.

→ Trial (1) :- 11.0600 - 6.7476 = 4.3124g ± 0.0001

→ Trial (2) :- 11.6419 - 6.6477 = 4.9942g ± 0.0001

→ Trial (3) :- 11.5986 - 6.6477 = 4.9509g ± 0.0001

3 Actual volume [mL] in this experement the temperture of water found equals [24.0 ± 0.5°C] so for (1g) of water the volume is 1.0036 mL from table (2)

→ Trial (1) :- 1g → 1.0036 mL
4.3124g → ??
Actual volume = 4.3279

→ Trial (2) :- 1g → 1.0036 mL
4.9942 → ??
Actual volume = 5.0122

→ Trial (3) :- 1g → 1.0036 mL
4.9509 → ??
Actual volume = 4.9687

Correction :- Correction = Actual volume - apparent volume.

→ Trial (1) :- 4.3279 - 4.70 = -0.37 mL

→ Trial (2) :- 5.0122 - 5.00 = 0.01 mL

→ Trial (3) :- 4.9687 - 5.10 = -0.13 mL

Conclusion :-

I learned how to calibrate the Glassware & Clean the glassware by using a buratte the quality of ~~$~~ my date was not bad. I think I made sone mistake.

Seen

Sources & error :-

Personal errors → errors on signficant figurs
→ errors in reading burette
→ errors in measurments.

Random errors → enviromantal conditions
→ the change of temprefure.

Systemic errors ⇒ the balance not at zero
→ Burette or flask are not clean

Question :-

A 25.00 mL piptte was found to deliver 24.976 g of water when calibrated against stainless steel weight at 25°C. Use the date in Table (2) to calculate the volume delivered by the pipette at this temprefure and at 20°C.

ans:

at 25°C

1g → 1.0038 mL
24.976 → ?? mL

Actual volume

at 20°C

1g → 1.0028 mL
24.976g → ?? mL

Actual volume

orrection :-

Correction = Actual volume − apparent volume.

→ Trial (1) :- 4.3279 − 4.70 = −0.37 mL

→ Trial (2) :- 5.0122 − 5.00 = 0.01 mL

→ Trial (3) :- 4.9687 − 5.10 = −0.13 mL

Conclusion :-

I learned how to calibrate the Glassware & Clean the glassware by using a buratte the quality of ~~f~~ my data was not bad. I think I made sone mistake.

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Sources of error :-

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Systemic errors ⇒ the balance not at zero
→ Burette or flask are not clean

Question :-

A 25.00 mL pipette was found to deliver 24.976g of water when calibrated against stainless steel weight at 25°C. Use the data in Table (2) to calculate the volume delivered by the pipette at this temprefure and at 20°C.

ans:

at 25°C

1g → 1.0038 mL
24.976 → ?? mL

Actual volume
= 25.0709 mL

at 20°C

1g → 1.0028 mL
24.976g → ?? mL

Actual volume
= 25.0459 mL

Analalical Chemistry:

9.5/10

Name:- Majd emad Al-zoubi

Reg No :- 0222387

Locker No :- 163

section No :- 9

Instractor :- Dr. Mohammad Rashed

Date of exp :- 21-10-25

Tittle of exp :- sampling and statistical Treatment (2)

0.1

Experiment 2

Data Sheet and Calculations

Name: Majd emad Al-zoubi **Section:** 9

Reg. No.: 0222387 **Date:** 21/10/2025

A. Homogenous sample

Result no.	V_S	V_B ±0.07	V_S-V_B ±0.1
1	0.10 19.20 = 19.10 ±0.07	41.70 41.90 = 0.20 ±0.05	18.90±0.09
2	19.20 35.50 = 16.30 ±0.07	= 0.20 ±0.05	16.10± 0.09
3	35.50 41.70 = 6.2 ±0.07	0.20±0.05	6.00 ±0.09
4			
5			

B. Non-homogenous sample

Result no.	V_S	V_B ±0.07	V_S-V_B ±0.1
1	7.10 17.60 = 10.50 ±0.07	39.30 39.60 = 0.30 ±0.05	10.20±0.09
2	17.60 28.30 = 10.70 ±0.07	0.30±0.05	10.40±0.09
3	28.30 39.30 = 11.00 ±0.07	0.30±0.05	10.70±0.09
4			
5			

Instructor's Signature:

Instructor's Name: 21-10-2025

Calculations :-

→ Homogenous - sample :-

1- equation of the princple reaction in the analysis ⇒

$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

2- $(V_s - V_B)$ → trial 1 ⇝ $19.10 - 0.20 = 18.90 \pm \cancel{0.09}$

→ trial 2 ⇝ $16.10 - 0.20 = 16.10 \pm \cancel{0.09}$ $\boxed{\pm 0.1}$

→ trial 3 ⟶ $6.2 - 0.20 = 6.00 \pm \cancel{0.09}$

3- uncertinty ⇒ for (V_s) $V_s = V_f - V_i \Rightarrow \sqrt{(0.05)^2 + (0.05)^2} = \pm 0.07$

for (V_B) $\frac{1}{2}$ * least devision $= \frac{1}{2} * 0.1 = \pm 0.05$

for $(V_s - V_B)$ $\sqrt{(0.07)^2 + \underset{(0.07)^2}{(0.05)^2}} = 0.086 \approx \pm 0.09$ -0.5

4- Apply Q-test for homogenous sample :- Qcritical (0.642)

valus → (18.90 , 16.10 , 6.00)

$$Q_{exp} = \left| \frac{\text{suggested data} - \text{closer data}}{\text{maximum value} - \text{minumum value}} \right| =$$

$$Q_{exp} = \left| \frac{18.90 - 16.10}{18.90 - 6} \right| = 0.217 < 0.642$$ → Accepted

$$Q_{exp} = \left| \frac{6 - 16.10}{18.90 - 6} \right| = 0.782 > 0.642$$ → rejected

* mean :- $\frac{1}{n}\sum x = \frac{18.90 + 16.10 + 6}{3} = 13.66$

* median :- (16.10)

* Average devison from the mean : $\sum_{i=1}^{i=N} \frac{|x_i - \bar{x}|}{N} = \frac{7.6667 + 2.4333 + 5.2333}{3} = 5.11$

elative average devision $= \frac{\text{Average devison}}{\bar{X}} * 100\% = \frac{5.11}{13.66} * 100\% = 37.4$

Average diviation from the median $= \frac{\sum |X_i - \bar{y}|}{N} * 100\% = 4.3$

Relative averge diviation from the median $= \frac{\text{Average deviation}}{\bar{y}} = \frac{4.3}{16.1} * 100\% = 26.71\%$

standerd diviation $= \sqrt{\frac{\sum (X - \bar{X})^2}{N-1}} = 6.785$

Relative standern divation $= \frac{S}{\bar{X}} * 100\% = \frac{6.785}{13.66} = 49.67\%$

* Non homogeneous sample :-

1- $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

$(V_S - V_B) \longrightarrow$ trial 1 $\rightsquigarrow 10.50 - 0.30 = 10.20 \pm \cancel{0.09}$

trial 2 $\rightsquigarrow 10.70 - 0.30 = 10.40 \pm \cancel{0.09}$ ± 0.1

trial 3 $\rightsquigarrow 11.00 - 0.30 = 10.70 \pm \cancel{0.09}$

2- uncertenity $\Rightarrow$ for (V_S) $V_S = V_f - V_i = \sqrt{(0.05)^2 + (0.05)^2} = \pm 0.07$

for (V_B) $\frac{1}{2} *$ least devison $= \frac{1}{2} \times 0.1 = \pm 0.05$

for $(V_S - V_B) \rightarrow \sqrt{(0.07)^2 + \underset{(0.07)^2}{\cancel{(0.05)^2}}} = \pm 0.09$

3- Q test at 95% ($Q_{critical} = 0.642$) values → [illegible] 10,20, 10.40 10,70

$Q_{exp} = \left| \frac{10.20 - 10.40}{10.70 - 10.20} \right| = 0.4 < 0.642$ → accepted

$Q_{exp} = \left| \frac{10.70 - 10.40}{10.70 - 10.20} \right| = 0.6 < 0.642$ → accepted

mean $= \bar{X} = \frac{1}{N} \sum X_i = 10.43$

median $= \bar{y} = 10.40$

erage deviasion from mean $= \frac{\Sigma|x-\bar{x}|}{N} = 0.176$

Relatvie deviasion from mean $= \frac{\text{Average deviation}}{\bar{X}} \times 100\% = 1.69\%$

Average deviasion from median $= \frac{\Sigma|x_i-\bar{y}|}{N} = 0.166$

Relative deviasion from median $= \frac{\text{Average deviation}}{\bar{y}} \times 100\% = 1.60\%$

standerd deviasion $= \sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}} = 0.251$

Relatve standerd deviasion $= 2.406\%$

Question :-

1 Compar the results of the ~~[illegible]~~ tow groubs in termof :-

	Homo genous	Non-Homogenous
mean	~~[illegible]~~ 13.66	10.43
standerd divation	6.785	0.251
Relative standerd deviation	49.67	2.406

2 Calcalute the molar concentration of Acetic Acid for both grops of results

Homogenous sanple $M * V(NaOH) = M * V_{CH_3COOH}$

$0.1 * (13.66) = M * (10.0)$ $\boxed{M_{CH_3COOH} = 0.1366\ M}$

Non-Homogenous $M V_{NaOH} = M V_{CH_3COOH}$

$0.1 (10.43) = M (10.0)$ $\boxed{M = 0.1043\ M}$

3 Relative errors (Accuracy)

Homogenous $\frac{x_i - x_t}{x_t} * 100\% = \frac{0.1366 - 0.1}{0.1} * 100\% = 36.6\%$

Non-Homogenous $\frac{x_i - x_t}{x_t} * 100\% = \frac{0.1043 - 0.1}{0.1} * 100\% = 4.3\%$ (more Accurate)

→

cision → R.S.D → homo → 49.67
↳ non homo → 2.406 ✓ more perision

Errors

* most erros are personal like:

1 change the color of solution and there for exact point

2 Errors in measuring volume of NaOH inthe burret

3 error on cleaing the burret, pipets, flask, Beakar.

Name :- Majd emad Al-zoubi

$\frac{8}{10}$

Reg No :- 0222387

lokker No :- 163

section No :- 9

Instructor :- Dr Mohammad Rashed

Titlle of exp :- Neutralization Titration in Aqueos Mediom

Date of delivery Reports :- 4/11/2025

Exp NO :- (3)

unk

9

Experiment 3

Date Sheet and Calculations

Name: Majd emad Al-zoubi **Section:** 9.
Reg. No.: 0222387 **Date:**

Mass of Na_2CO_3	0.5134 ±0.0001
(A) Vol. of Na_2CO_3	**Vol. of HCl**
1. 10.00±0.05 **2.** 10.00 ±0.05 **3.**	10.30 ± 0.07 10.55± 0.07
(B) Vol. of NaOH	**Vol. of HCl**
1. 10.00 ±0.05 **2.** 10.00 ±0.05 **3.**	12.90 ±0.07 [illegible] 15.8 ±0.07

(C) Vol. of H_3PO_4	**Vol. of NaOH**	**Indicator**
1. 7.90±0.07	[illegible] ±0.07 11.00	Bromocresol
2. 13.70 ±0.07	24.6 ±0.07	phenol phthalene.

10.00 ±0.05
10.00± 0.05

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: Deema Ahmad

28-10-2025

alclations :-

→ part "A" :-

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$ (base → acid / blue → yellow)

↳ indicater: in this case we will use Bromo-cresol - Green.

1- mass of Na_2CO_3 = 0.5134 ± 0.0001 → uncertainty for balance (0.0001)

2- molar mass of Na_2CO_3 = 105.988 g/mol

3- moles of Na_2CO_3 = $\frac{\text{mass}}{\text{molar mass}}$ = 4.843×10^{-3} mol

4- moles of Na_2CO_3 = 4.843×10^{-3} mol

5- M of Na_2CO_3 = $\frac{\text{moles}}{\text{Volume(L)}} = \frac{4.843 \times 10^{-3}}{100 \times 10^{-3}\ L} = 0.0484\ M$

volume of HCl = $\frac{10.30 + 10.65}{2}$ = 10.475 mL ± 0.1 → uncertainty $= \sqrt{(0.07)^2 + (0.07)^2} = \pm 0.1$

stichometry :- 1 mole Na_2CO_3 : 2 mol HCl

M of HCl :- $2\,MV_{Na_2CO_3} = MV_{HCl}$

$2(0.0484)(10) = M * 10.475$

$\boxed{M_{HCl} = 0.0924}$

→ part "B" :-

uncertainty of Volume 0.07 → $\sqrt{(0.05)^2 + (0.05)^2} = 0.07$

$NaOH + HCl \longrightarrow NaCl + H_2O$ (pink (acidic) → color less (basic))

↳ indecater : phenophthalein

$\bar{V}_{HCl} = \frac{12.90 + 15.8}{2} = 14.35 \pm 0.1$ → uncertainty $\sqrt{(0.07)^2 + (0.07)^2} = 0.1$

$\bar{V}_{NaOH} = \frac{10.00 + 10.00}{2} = 10.00\ mL \pm 0.07$ → $\sqrt{(0.05)^2 + (0.05)^2} = 0.07$

stiochiometry = 1 mole NaOH = 1 mole HCl

M of NaOH $M\bar{V}_{NaOH} = M\bar{V}_{HCl}$

$M(10.00)\ mL = (0.0924)(14.35)$

$\boxed{M_{NaOH} = 0.1325\ M}$

alculations :-

→ unkown number → 9

[1] Neutralization of one proton :-

$H_3PO_4 + NaOH \longrightarrow NaH_2PO_4 + H_2O$ ⇝ pH = 4.6

↳ indicator :- Bromocresol green. from yelow (acid) → blue (basic)

11 + ~~24.6~~

$\bar{V}$ of NaOH = $\frac{(7.90 + 13.70) \pm 0.07}{2} = 10.8 \pm 0.1$ ↳ $\sqrt{(0.05)^2+(0.05)^2}$ ↳ $\sqrt{(0.07)^2+(0.07)^2}$

$\bar{V}$ of H_3PO_4 = $\frac{(0.00 + 10.00)mL \pm 0.05}{2}$ = 10.00 mL ± 0.07 ↳ $\frac{1}{2} \times 0.1$ ↳ $\sqrt{(0.05)^2+(0.05)^2}$

stiochiometry = 1mole H_3PO_4 = 1mole NaOH

$M\bar{V}_{H_3PO_4} = M\bar{V}_{NaOH} \longrightarrow M_{H_3PO_4} = \frac{(0.1325)(10.8)}{10} = 0.1431 M$

molar mass of H_3PO_4 = 97.994 g/mol * 0.1431 $\frac{mol}{L}$ = 7.94 g/L

[2] Neutralization of two protons.

$H_3PO_4 + 2NaOH \rightarrow Na_2HPO_4 + 2H_2O$ ⇝ pH = 9.7

↳ Indicator = phenopthalein (color Less (acidic) → pink (basic)

24.6

* $\bar{V}$ of NaOH = $\frac{(11.00 + 24.6) \pm 0.07}{2}$ = 17.8 ml ± 0.1 ↳ $\sqrt{(0.05)^2+(0.05)^2}$ ↳ $\sqrt{(0.07)^2+(0.07)^2}$

* $\bar{V}$ of H_3PO_4 = $\frac{(10.00 + 10.00) \pm 0.05}{2}$ = 10.00 ml ± 0.07 ↳ $\frac{1}{2} \times 0.1$ ↳ $\sqrt{(0.05)^2+(0.05)^2}$

* stiochimetry = 1mole H_3PO_4 = 2moles NaOH

-2

~~Mol H_3PO_4~~ = $2M\bar{V}_{H_3PO_4} = M\bar{V}_{NaOH}$

$$M_{H_3PO_4} = \frac{(0.1325) * (17.8)}{2(10.00)mL} = 0.1179 M$$

molar mass of H_3PO_4 = 97.994 g/mol. * 0.1179 $\frac{mol}{L}$ = 11.555 g/L

total concentration = $\frac{11.555 + 7.94}{2}$ = 9.74 $\frac{g}{L}$

Sources of errors :-

① errors in measurment

② errors in the balance if it isn't calibrated well

③ error on buret and pipet.

Questions :-

1) How do you determine solubility of calcium hydroxide by a sample acid-base titration ?

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

b) pipette certain volume of the $Ca(OH)_2$ standard solution.

c) Titrate against a weak or stronge acid with a known concentration (HCl) acid and put a propriate indicator.

d) find the solubility of $Ca(OH)_2$ ⟶ by the equation of titration

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

for 1 mole of $Ca(OH)_2$ → 2 mole of HCl

e) According to the above equation :- $M_{Ca(OH)_2} = \frac{MV_{HCl}}{2V_{Ca(OH)_2}}$

$$M_{Ca(OH)_2} = [Ca^{+2}]$$

$$\longrightarrow \text{solubility of } Ca(OH)_2 = [Ca^{+2}] = \frac{1}{2}[OH^-]$$

② How do you determine the water of crystillization of washing soda?

a) prepare a solution putting a known mass of hydrate solution carbonate in a distiled water.

b) make the volume of the solution that has beed prepared.

put Methyl oranage indicator or any appropriate indicator

ⓓ Titrate with aKnown molarity with HCl (strong acid), at the end point the color will change from yellow to pink.

ⓔ According to this equation :- $Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$

$\hookrightarrow \frac{1}{2} M_1 V_{NACO_3} = M_2 V_{2HCl}$

ⓖ calculate the mass of H_2O = mass of Na_2CO_3 - mass of Na_2CO_3

Ⓗ calculate the mole of H_2O → n = mass / Molar mass

I) x water of crystillization = $\frac{\text{moles of } H_2O}{\text{moles of } Na_2CO_3}$

Questions

③ why two indicator can be used for detemination of phosphric acid?

Becouse H_3PO_4 has 3 protons in titration with NaOH and each end point occurrs c at acertain

④ could you make titration for NH_3 solution with a standred solution of CH_3COOH ? why?

No, becouse NH_4OH is weak base and (CH_3COOH) is a weak base acid and there is not weak acid-base. titration → idicator can't work beouse we have diffrent (pH)

→ Also, we will need alarge amount of titrate to the equivalance. point

- Name :- Majd emad Al-zoubi

8.5/10

- Reg No :- 0222387

- locker No :- 163

- Instructor :- Dr - Mohammed Rasheed.

- Tittle of Experement :- precipitation Titrations (Argentometry)

- Data of Delivery Reports :- 11/11/2025

- Exp. No :- "4"

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Experiment 4

Data Sheet and Calculations

Name: Majd emad Al-zoubi
Reg. No.: 0222387
Section: 9
Date: 4/11/2025

Mass of NaCl: 0.5502 ± 0.0001

(A) Mohr's method	ind: potassium chromate Trial (1)	ind: Mixed indicater Trial (2)
Vol. of NaCl solution Vol. of AgNO₃ solution	10.00 ± 0.05 10.20 ± 0.07	10.00 ± 0.05 mL 10.40 ± 0.07 mL
(B) Fajan's method		
Vol. of NaCl solution Vol. of AgNO₃ solution	10.00 ± 0.05 10.50 ± 0.07	10.00 ± 0.05 mL 10.30 ± 0.07 mL
(C) Volhard's method		
Vol. of AgNO₃ solution Vol. of KSCN solution	10.00 ± 0.05 9.9 ± 0.07	10.00 ± 0.05 mL 10.15 ± 0.07 mL

?!

?!

Unknown mixture ID: potassium chromate		
(I) According to Mohr's method	Trial 1	Trial 2
Vol. of unknown solution Vol. of AgNO₃ solution	10.00 ± 0.05 10.40 ± 0.07	10.00 ± 0.05 9.60 ± 0.07
(II) According to Volhard's method		
Volume of unknown solution Vol. of KSCN solution Vol. of AgNO₃ added in excess		

Instructor's Signature: Fatema abdulah

Instructor's Name: 4/11/2025

10.40

9.80

alculations:-

part "A" → standarization of stiver nitrate by Mohr's methods

*equations $Ag^+ + Cl^- \rightleftharpoons AgCl_{(s)}$ → white color

$2Ag^+ + CrO_4^{-2} \rightleftharpoons Ag_2CrO_{4(s)}$ → reddish-brown color.

Indicators:- trial(1) → potassium chromate

trial(2) → Mixed indicator (potassium chromate of potassium dicromate

→ color → reddish -(Brown)

0.5502 g −0.5

① mass of (NaCl) : ~~0.6285~~ ± 0.0001 g → uncenteinty for balance.

② volume of (NaCl) solution (for trial(1),2) : 10.00 mL ± 0.05 → $\frac{1}{2}$ * Least diresion

③ volume of $(AgNO_3)$ solution $(V_f - V_i)$:- trial "1" → 10.20 ± 0.07 mL → $\sqrt{(0.05)^2 + (0.05)^2} = 0.07$

trial "2" → 10.40 ± 0.07 mL → $\sqrt{(0.05)^2 + (0.05)^2} = 0.07$

$\bar{V}(AgNO_3) \rightarrow \frac{V_1+V_2}{2} = \frac{(10.40+10.20)\,mL}{2} = \boxed{10.30\ mL \pm 0.1}$ → $\sqrt{(0.07)^2+(0.07)^2} = 0.1$

number of moles (NaCl) $= \frac{\text{mass NaCl}}{\text{molar mass NaCl}} = \frac{0.5502\ g}{58.44\ g/mol} = \boxed{9.4148 \times 10^{-3}\ mol}$

molarity of (NaCl) $= \frac{\text{number of moles}}{\text{volume on (L)}} = \frac{9.4148\times10^{-3}\ mol}{100\times10^{-3}\ (L)} = \boxed{0.0941\ M}$

$(M\bar{V})_{NaCl} = (M\bar{V})_{AgNO_3} \longrightarrow 0.0941 * 10\ mL = M_{AgNO_3}\ (10.30)\,mL$

$\boxed{M_{AgNO_3} = 0.09140\ M}$

(g/L) coffitiant → $0.09140\ \frac{mol}{L} * 169.872\ \frac{g}{mol} = \boxed{15.52\ g/L}$

part "B" → standarization of silver nitrate by Fajan's method

equation: $NaCl + AgNO_3 \rightleftharpoons AgCl_{(s)} + NaNO_3$ → color (green) → pink

*indicators = 5-Drops of Dichloro flurosein

① mass of NaCl = 0.5502 ± 0.0001 g → uncertainty → for balance

② number of moles (NaCl) = 9.4148×10^{-3} mol

③ volume of NaCl : 10.00 mL ± 0.05 → $\frac{1}{2}$ * least ~~con~~ diversion.

④ volume of $(AgNO_3)$ $V_f - V_i$ → trial ① : 10.50 ± 0.07

trial ② : 10.30 ± 0.07 → $\sqrt{(0.05)^2+(0.05)^2} = \boxed{0.07}$

$2 \qquad 2 \qquad = 10.40 \text{ ml} + 0.1 \rightarrow \sqrt{(0.07)^2+(0.07)^2}$

⑥ $MV_1(NaCl) = MV(AgNO_3) \rightarrow (\overset{0.0941}{~~[illegible]~~}) * (10 \text{ mL}) = M_{AgNO_3} * 10.40 \text{ ml}$

$\boxed{M_{AgNO_3} = ~~[illegible]~~ M}$

$= 0.0904$

⑦ g/L → coeffintant AgNO₃ → $\overset{0.0904}{~~[illegible]~~} \frac{mol}{L} * 169.872 \frac{g}{mol} = \boxed{15.37 g/L}$ #

⟹ The anenage value for (M & (g/L)) for AgNO₃ from part (A + B)

→ $M = \frac{M_1 + M_2}{2} = \frac{0.09140 + 0.0904}{2} = 0.0907 M$

→ $g/L = \frac{(g/L)_A + (g/L)_B}{2} = \frac{15.52 + 15.37}{2} = 15.44 \; g/L$

---

part "C" → standrization of potasium Thiocyante

equations :

$Ag^+ + SCN^- \rightleftharpoons AgCl_{(s)}$ white color

$Ag^+ + SCN^- \rightleftharpoons AgSCN_{(s)}$ white preiptate

$Fe^{+3} + SCN^- \rightleftharpoons [Fe(SCN)]^{-2}$ Red-Brown color

① volume of (AgNO₃) solution = 10.00 ± 0.05 → $\frac{1}{2} * 0.1 = 0.05$

tiral (1,2) using pipet.

② volume of (KSCN) solution - trial ① → 9.90 ± 0.07

$(V_f - V_i)$ trial ② → 10.15 ± 0.07 → $\sqrt{(0.05)^2 + (0.05)^2}$

$= 0.07$

$\bar{V}(KSCN) = \frac{V_1 + V_2}{2} = \frac{(9.90 + 10.15) \pm 0.07}{2} = \boxed{10.02 \text{ mL} \pm 0.1} \rightarrow \sqrt{(0.07)^2 + (0.07)^2}$

$M(AgNO_3)$ from A & B part $= \boxed{0.0907 M}$

$(MV)_{AgNO_3} = (MV)_{KSCN} \rightarrow = \frac{0.0907 * (10.00)}{10.02 \text{ ml}} = \boxed{0.0905 M_{(KSCN)}}$

(g/L) cofficcant → $0.0905 \frac{mol}{L} * 97.18 g/mol = \boxed{8.7966 g/L}$

part D → determination of an unkown mixture of halides (NaCl + KCl)

No of unkown = $\boxed{45}$

① Mohr method:-

① volume of (unkown solution) = 10.00 ml ± 0.05 → $\frac{1}{2} \times 0.1 = 0.05$

② volume of ($AgNO_3$) solution = trial ① → 10.40 ± 0.07

trial ② → 9.60 ± 0.07

$\sqrt{(0.05)^2 + (0.05)^2} = 0.07$

③ $\bar{V}$ of ($AgNO_3$) = $\frac{V_1 + V_2}{2} = \frac{(10.40 + 9.60) \pm 0.07}{2}$ = 10.00 ± 0.1 → $\sqrt{(0.07)^2 + (0.07)^2}$

indicator: potassium chromate

④ mass of unkown = 0.065g $x + y = 0.065g$ x → mass of NaCl y → mass of KCl

⑤ M of $AgNO_3$ = 0.0907 M → from A&B

⑥ number of moles ($AgNO_3$) = $M\bar{V} = 0.0907 \times 10.00 \times 10^{-3} L = \boxed{0.907 \times 10^{-3} \text{ moles}}$ or

$x + y$ → masses sum → convert them to number of moles :-

$$\frac{x}{58.5} + \frac{y}{74.5} = 0.907 \times 10^{-3} \rightsquigarrow ①$$

$$x + y = 0.065 \rightsquigarrow ②$$

$$\frac{74.5x}{(58.5)(74.5)} + \frac{y(58.5)}{(74.5)(58.5)} = 0.907 \times 10^{-3} \rightarrow \frac{74.5x + 58.5y}{4358.25} = 0.907 \times 10^{-3}$$

$x + y = 0.065 \rightarrow \boxed{y = 0.065 - x}$ → نعوض

$$\frac{74.5x + 3.8025 - 58.5x}{4358.25} \times 0.907 \times 10^{-3}$$

$3.9529 = 16x + 3.8025$

موضح فوق — $x = 9.4$ [illegible] $\times 10^{-3}$ g NaCl → (g/L) = $\frac{\text{mass NaCl}}{V(L)} = \frac{9.4 \ldots \times 10^{-3}}{10 \times 10^{-3}}$ $\boxed{= 0.94}$ g/L

$y = 0.0556$

→ (g/L) = $\frac{\text{mass KCl}}{V(L)} = \frac{0.0556}{10 \times 10^{-3}}$ $\boxed{= 5.56}$ g/L

$$\boxed{\begin{array}{l} x = 0.94 \text{ g/L} \\ y = 5.56 \text{ g/L} \end{array}}$$

Q1: Why precipitation titrations by Mohr's method requirs aneutral solution?

Anss-

Becuse if we basic the silver whould react. so we will lose part of the silver that we want to calibrate in, and if the maximum was acidic It would produce ($K_2Cr_2O_7$) & there for we also have errors.

Q2: what is the effect of using acidic solution in the Fajans' method?

Ans:-

It is possible to produce FeOH, so we will ~~take~~ longer to reach the end point and alot of mistakes.

Q3: what is the effect of using ($K_2Cr_2O_7$) instead of K_2CrO_4 as an indicator on the titration results?

Ans: Becouse the $K_{sp} \rightarrow K_2Cr_2O_7 > K_2CrO_4$ the end-point it will need less than the titration.

Q4: what is the effect of using basic solution on the results in precipitation?

Ans: in fajan and Mohr's we will have ($AgOH$) so we need more silver nitrate to reach endpoint as for volhard, Iron reach with (OH) & we need also more silver.

Q5: why nitrobenzene. is added in case of titration of Cl^- by the Volhard's methods?

Ans: sliver dosn't react with (SCN) and there foro we need more Large amount.

cover the surface of $AgCl_{(ppt)}$, and prevent the following Rxn

$$AgCl + SCN^- \rightleftharpoons AgSCN + Cl^-$$

Name :- Majd emad Al-zoubi

Reg No :: 0222387

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locaker No:: 163

Instructor :- Dr. Mohammad Rasheed.

Date to Dilvery :- 19. 11. 2025

section :- 9

Experement Number : 5

Titlle of the experement :- Redox Titrations (Dichroatic titrations)

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Experiment 5

Data Sheet and Calculations

Name: Majd Al-Zoubi
Reg. No.: 0222387

Section:
Date: 11/11/2025

Unknown ID No.: 36	
(A) Determination of Fe^{2+} in a mixture	
Vol. of unknown solution	**Vol. of $K_2Cr_2O_7$**
1) 10.00 ± 0.05	5.10 ± 0.07
2) 10.00 ± 0.05	4.60 ± 0.07
3)	
(B) Determination of Fe^{3+} after reduction	
Vol. of unknown solution	**Vol. of $K_2Cr_2O_7$**
1) 10.00 ± 0.05	5.50 ± 0.07
2)	

Wt. of Fe^{2+} per liter = 3.250 g/L
Wt. of Fe^{3+} per liter = 0.435 g/L

Instructor's signature: fatema abdullah

Instructor's Name: ..

11/11/2025

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lculations:-

Number of unkown (36)

→ part A Determine of Fe^{+2} in amixture

equation $(Fe^{+2} \longrightarrow Fe^{+3} + e^{-}) \times 6$

$$Cr O_7^{-2} + 14H^{+} + 6e^{-} \longrightarrow 2C^{+3} + 7H_2O$$

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

① volume of unkown = 10.00 mL ±0.05 → $\frac{1}{2} \times$ Least division
(in two trial)

$\frac{1}{2} \times 0.1 = 0.05$

② volume of H_2SO_4 = 10.00 mL ± 0.05

③ volume of H_3PO_4 = 5.00 mL $(V_f - V_i)$

④ volume of $K_2Cr_2O_7$ = trial1) = V = 5.10 ± 0.07 → $\sqrt{(0.05)^2 + (0.05)^2}$

trial (2) = V = 4.60 ± 0.07 → $\sqrt{(0.05)^2 + (0.05)^2}$

$$\bar{V} = \frac{V_1 + V_2}{2} = \frac{4.60 + 5.10}{2} = 4.85 \pm 0.1 \rightarrow \sqrt{(0.07)^2 + (0.07)^2}$$

⑤ Amount (Fe^{+3}) (g/L) = $M_{K_2Cr_2O_7} = 0.02M$

$V_{K_2Cr_2O_7} = 4.85 mL$

$$6 \times M \times V_{K_2CrO_7} = M V_{Fe^{+2}}$$

$$10^{-3} \times 6 \times 4.85 \times 0.02 = M \times (10.00 \times 10^{-3})$$

$$\boxed{M_{Fe^{+2}} = 0.0582 M}$$

molar mass of Fe = 55.845 g/mol

$$\Rightarrow 0.0582 \frac{mol}{L} \times 55.845 \frac{g}{mol} = \boxed{3.250 \frac{g}{L} \text{ [illegible]}}$$

#B : Determine of Fe^{+3} alter reduction

formula → Fe^{+3} + Joha's reductor → Fe^{+2}

① volume of unkown solution = 10.00 ± 0.05 mL $\rightarrow$ $\frac{1}{2}$ × Least divesion
$\frac{1}{2}$ × 0.1

② volume of $K_2Cr_2O_7$ = 5.50 ± 0.07 mL $\rightarrow$ $\sqrt{(0.05)^2 + (0.05)^2}$

③ $6M * V_{K_2Cr_2O_7} = M V_{Fe^{+2}}$

$6(0.02) * (5.25\ mL) = M(10.00) mL$

$\boxed{M = 0.066\ M}$

④ $0.066 \frac{mol}{L} * 55.845 \frac{g}{moL} = \boxed{3.685 \frac{g}{L}\ Fe^{+2}}$

$\boxed{Fe^{+3}\ g/L} = Fe^{+2}(B) - Fe^{+3}(A)$

= [illegible]

$3.685 - 3.250 = \boxed{0.435 \frac{g}{L}\ Fe^{+3}}$

sourses of error

① not comlete reduction of Fe^{+3}

② Error when we use pipete

③ Error when we read final inlial readig of the buret.

hat is the role of H_3PO_4 in determiation of Fe^{+3} by titration with $K_2Cr_2O_7$?

$_3PO_4$ reacts with yelow Fe^{+3} (resulting for titration to form $[Fe(HPO_4)]$ which is colorless so that the end point of reduction is more clearly visible Morever, H_3PO_4 lowers the reduction potential and Fe^{+3} - Fe^{+2} couple by complexation (Fe^{+3} is reduced) and hence tends to increase the reducing power of Fe^{+2}.

* Can you determine Iron in ores using $K_2Cr_2O_7$?

yes, Iron, Becouse the iron ores contains Fe_2O_3 and Fe_3O_4 which can be dissolved in an acidic solution in ordar to have Fe^{+3} and reduced it as the equation $Fe^{+3} + e^- \longrightarrow Fe^{+2}$ then titrate it with titrant $Cr_2O_7^{-2}$ with the use of H_3PO_4 and diphenylomine sulfuric acid indicator.

* How could you check that Fe^{+3} has been completely reduced to Fe^{+2} ?

when the yellow color has disappeared entirely; this confirm that all Fe^{+3} has been reduced to Fe^{+2}. Also, to check the complete reduction of Fe^{+3}, one drop of the solution is added to adrop of NH_4SCN an a procelaintile, if no blood-red-color formation appear, this means that there is acomplete reduction of Fe^{+3} to Fe^{+2}.

partical Analytical Chemistry

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Name :- Majd emad Al-zoubi

Reg No :- 0222387

lokar No :- 163

Date Delevery :- 25-11-2025

experemet :- Redox titration (iodine titration)

exp No :- "6"

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Experiment 6

Data Sheet and Calculations

Name: Majd emad Al-zoubi
Reg. No.: 0222387
Section:
Date:

(A) Standardization of 0.1M thiosulfate

Wt of KIO_3 = 0.4861 ± 0.001 g

Volume of KIO_3	Volume of $Na_2S_2O_3$
1- ~~[illegible]~~ 10.00 ±0.05 ml	12.80±0.07 ml
2- 10.00±0.05 ml	12.50 ± 0.07 ml
3- 10.00±0.05 ml	ml

(B) Standardization of 0.1M iodine:

Volume of I_2	Volume of $Na_2S_2O_3$
1- 10.00±0.05 ml	13.40 ±0.07 ml
2- 10.00 ±0.05 ml	14.50±0.07 ml
3- 10.00 ±0.05 ml	ml

(C) Determination of tin in the unknown:

Unknown ID # : 30

Volume of I_2	volume the unknown solution	Volume of $Na_2S_2O_3$
1- 15.00±0.05 ml	10.00±0.05 ml	ml 12.30±0.07
2- ml	ml	ml [redacted]
3- ml	ml	ml

Instructor's Signature:
Instructor's Name: Deema Ahmad

18-11-2025

alations :-

$IO_3 + 5KI + 6HCl \longrightarrow 3I_2 + 3H_2O + 6KCl$

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

→ $V(KIO_3) = 10.00\,mL$, $wt(KIO_3) = 0.4861\,g + 0.001$ $\xrightarrow{}$ $\frac{1}{2} \times$ at least value $Mw_{KIO_3} = 214\,g/mol$

→ $\bar{V}\, Na_2S_2O_3 = \frac{12.80 + 12.5}{2} = 12.65\,mL \pm 0.1 \rightarrow \sqrt{(0.07)^2 + (0.07)^2}$

$Mw\; Na_2S_2O_3 = 158\,g/mol$

* $n(KIO_3) = \frac{m}{mm} = \boxed{2.271 \times 10^{-3}\ mol(KIO_3)}$

* $M(KIO_3) = \frac{mol}{Volume} = \frac{2.271 \times 10^{-3}}{10.00 \times 10^{-3}} = \boxed{0.02271\ M(KIO_3)}$

* $1(KIO_3) \longrightarrow 3I_2$

$2.271 \times 10^{-3}(1KIO_3) \longrightarrow ??$ $\boxed{n(I_2) = 6.813 \times 10^{-3}\ mol(I_2)}$

* $1I_2 \longrightarrow 2S_2O_3^{-2}$

$6.813 \times 10^{-3} \longrightarrow ??$ $\boxed{n_{S_2O_3^{-2}} = 0.0136\ mol(S_2O_3^{-2})}$

* $n(KIO_3) = \frac{n(S_2O_3^{-2})}{6} \rightarrow MV_{KIO_3} = MV_{S_2O_3^{-2}} \rightarrow M_{S_2O_3} = \frac{6(0.0227)(10.00 \times 10^{-3})}{12.65 \times 10^{-3}}$

$\boxed{M_{S_2O_3^{-2}} = \text{[illegible]}} \rightarrow = 0.1076\ \frac{mol}{L}$

* $M_{S_2O_3^{-2}}\left(\frac{g}{L}\right) \longrightarrow 0.1076\,\frac{\cancel{mol}}{L} * 158\,\frac{g}{\cancel{mol}} = \boxed{17.011\ g/L}$

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

→ $V(I_2) = 10.00 \pm 0.05\,mL$ $\longrightarrow$ $\frac{1}{2} \times 0.1 = \pm 0.05$

$\bar{V}(Na_2S_2O_3) = \frac{(13.40 + 14.50) \pm 0.07}{2} = 13.95\,mL$ $\longrightarrow \sqrt{(0.05)^2 + (0.05)^2}$

$Mw(I_2) = 253.81\,g/mol$

$n_{I_2} = \frac{n_{S_2O_3^{-2}}}{2}$

$M_1V_1 = \frac{M_2V_2}{2} \longrightarrow M_{I_2} * 10.00 = \frac{0.1076 * 13.95}{2}$

$\boxed{M_{I_2} = 0.075\ M\ I_2}$

$M_{I_2}\left(\frac{g}{L}\right) \longrightarrow 0.075\,\frac{\cancel{mol}}{L} * \frac{253\,g}{\cancel{mol}} = \boxed{18.98\ g/L}$

$n^{+2} + I_2 \longrightarrow Sn^{+4} + 2I^-$

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

unkown

(30)

→ $V(I_2) = 15.00 \pm 0.05$ → $\frac{1}{2} \times 0.1 = 0.05$

→ $V_{unkown} = 10.00 \pm 0.05$

→ $MW_{Sn^{+2}} = 118.7 g/mol$

→ $V_{S_2O_3} = 12.30 \pm 0.07$ → $\sqrt{(0.05)^2 + (0.05)^2}$

→ $n_{I_2} = n_{Sn^{+2}}$ → $n_{Sn^{+2}} = n_I - n_I$ result with $S_2O_4^{-2}$

$$MV_{I_2} - \frac{MV}{2} = MV_{Sn^{+2}}$$

~~[illegible]~~

$$(0.075)(15) - \frac{(0.1076)(12.30)}{2} = M(10)$$

$$1.125 - 0.6617 = 10M$$

$$\boxed{M_{Sn^{+2}} = 0.0463 M}$$

→ $M_{Sn^{+2}}(\frac{g}{L})$ → $0.0463 \frac{mol}{L} \times 118.7 \frac{g}{mol} = \boxed{5.498 \frac{g}{L}}$

Questions:-

1) not is strongly acidic median becouse don't want to hydrolysis of starch

2) to make sure that all the bacteria that convert $S_2O_3^{-2}$ to SO_4^{-2} be killed becouse it is very active in reaction with O_2.

3) when I do $Na_2S_2O_4$ standarization with the KIO_3, I must, during calibration move the Lasso, and I also need to be calibrated quickly. why? E to prevent or reduce the oxidation of I^{-1} by O_2.

4) Becouse they produce CO_2, which prevents oxidation from Occurring.

Analalycal pantical Chemistry .

Name :- Majd emad Al-zoubi

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Reg No :- 0222387

Section No :- "9"

Tittle of exp : Complexometric Tittration using EDTA

exp No : "7"

33

1.6

24.6
2

Experiment 7
Data Sheet and Calculations

Name: Majd emad Al-zoubi **Section:**

Reg. No.: 0222387 **Date:** 25.11.25

(A) Standardization of EDTA

Mass of $ZnSO_4.7H_2O$	0,3383 ± 0.0001			
Data	**Trial 1**	**Trial 2**	**Trial 3**	**Average**
Volume of $ZnSO_4.7H_2O$ Solution	10.00 mL ±0.05			
Volume of EDTA solution	22.6 ±0.07	21.5 ±0.07		22.05 ±0.1
Molarity of EDTA solution	—	—	—	5.30×10^{-3} M

(B) Determination of Water Hardness

Data	**Trial 1**	**Trial 2**	**Trial 3**	**Averag**
1- Vol. of tap water	50.00 mL ±0.05			
2- Vol. of EDTA solution (V_1) (corresponding to Ca and Mg)	12.50 ±0.07			
3- Vol. of tap water	50.00 mL ±0.05			
4- Vol. of EDTA (V_2) (corresponding to Ca)	7.30 ±0.07			

Ercnomate black ←

muiroxide ←

Deema Ahmad
25.11.2025

Majd emad Al-Zoubi

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Data	Trial 1	Trial 2	Trial 3	Average
Volume of EDTA Corresponding to Mg (V_1-V_2)	5.20 ±0.07			
ppm Ca	31.30 mg/L			
ppm Mg	13.39 mg/L			
Water hardness (mg $CaCO_3$/L)	132.6 mg/L			
(C) Unknown solution				
Unknown ID No.				
Data	**Trial 1**	**Trial 2**	**Trial 3**	**Average**
1. Vol. of unknown solution	10.00 mL ±0.05	10.00 ±0.05	—	10.00 ±0.07
2. Vol. of EDTA solution	36.40±0.07	37.70 ±0.07	—	37.05 ±0.1
3. ppm Ca and Mg	—	—	—	719.24 mg/L
4. Vol. of unknown solution	10.00mL ±0.05	10.00mL ±0.05	—	10.00 ±0.07
5. Vol. of EDTA solution	[redacted]	28.7 ±0.07	29.2 ±0.07	28.95 ±0.1
6. ppm Ca	—	—	—	614.93 mg/L

[redacted] Erio black

[redacted] miroxide

Instructor's Signature

Instructor's Name: Deema Ahmad

25.11.2025

36.5 37.2

quations for the principle reaction in the analysis :-

$$M^{+n} + H_2Y^{-2} \rightleftharpoons MY^{n-4} + 2H^+$$

↳ $M^{+n} \longrightarrow Ca^{+2}$ and Mg^{+2} so we have 2 equations :-

① $Ca^{+2} + H_2Y^{-2} \rightleftharpoons MY^{-2} + 2H^+$

② $Mg^{+2} + H_2Y^{-2} \leftrightarrows MY^{-2} + 2H^+$

→ part (A) : standarization of EDTA :-

① number of moles ($ZnSO_4 \cdot 7H_2O$) : $\frac{\text{mass}}{\text{molar mass}} = \frac{0.3383 \pm 0.0001}{287.54} =$

$$\boxed{n = 1.176 \times 10^{-3}}$$

② Molaity ($ZnSO_4 \cdot 7H_2O$) → $\frac{\text{number of moles}}{\text{volume (L)}} = \frac{1.176 \times 10^{-3}}{100 \times 10^{-3}} = \boxed{0.0117 M}$

$$\bar{V}[EDTA] = \frac{V_1 + V_2}{2} = \frac{(22.6 \pm 0.07) + (21.5 \pm 0.07)}{2} = \boxed{22.05 \pm 0.10}$$

$\sqrt{(0.05)^2 + (0.05)^2}$ $\sqrt{(0.07)^2 + (0.07)^2}$

④ Molarity EDTA = $(M\bar{V})_{ZnSO_4 \cdot 7H_2O} = M\bar{V}_{EDTA}$

$$(0.0117) * (10 \times 10^{-3}) = (22.05)(M \times 10^{-3}$$

$$\boxed{M_{EDTA} = 5.30 \times 10^{-3} M}$$

part (B) : Determination of water Hardness :-

① molar mass → ($Ca^{+2} \longrightarrow 40.078$ g/mol) ($Mg^{+2} \rightarrow 24.3050$ g/mol)

($CaCO_3 \rightarrow 100.086$ g/mol)

Calculations :-

$\boxed{I}$ ppm → Ca^{+2}

$V_1 \rightarrow V_{Ca^{+2}} + V_{Mg^{+2}}$ / $V_2 \rightarrow V_{Ca^{+2}}$

⟶

$M V_2)_{EDTA} = (M V)_{Ca^{+2}} \Rightarrow V_2 = 7.30 \pm 0.07$

$M_{Ca^{+2}} = \frac{5.30 \times 10^{-3} * 7.30 \times 10^{-3}}{50.00 \times 10^{-3}} \Rightarrow 0.778 \times 10^{-3}$

$ppm\ Ca^{+2} = \frac{0.773 \times 10^{-3}\ M}{L} * \frac{40.078 g/mol}{1} * \frac{10^3 mg}{g} = \boxed{31.30 mg/L}$

2 ppm Mg^{+2} $\rightarrow$ $V_{(corresponding\ to\ Mg^{+2})} = V_1 - V_2$

$= 12.50 \pm 0.07 - 7.30 \pm 0.07 \longrightarrow \sqrt{(0.05)^2 + (0.05)^2}$

$\boxed{= 5.20 \pm 0.1} \longrightarrow \sqrt{\cancel{(0.0}^2 + (0.07)^2}$

$\rightarrow (M V)_{EDTA} = (M V)_{Mg^{+2}} \longrightarrow M_{Mg^{+2}} = \frac{5.30 \times 10^{-3} * 5.20 \times 10^{-3}}{50.00 \times 10^{-3}}$

$M_{Mg^{+2}} = 5.512 \times 10^{-4} M$

$ppm(Mg^{+2}) = \frac{5.512 \times 10^{-4} mol}{L} * \frac{24.3050 g}{mol} * \frac{10^3 mg}{1 g} =$

$\boxed{= 13.39 \frac{mg}{L}}$

③ water Hardness $(M V_1)_{EDTA} = (M V)_{CaCO_3}$

$M_{CaCO_3} = \frac{5.30 \times 10^{-3} * 12.50 \times 10^{-3}}{50 \times 10^{-3}} = 1.32 \times 10^{-3} M$

$ppm\ CaCO_3 = \frac{1.32 \times 10^{-3} mol}{L} \Big| \frac{100.086 g}{mol} \Big| \frac{* 10^3 mg}{g}$

$\boxed{ppm\ CaCO_3 = 132.60 \frac{mg}{L}}$

Calculation:

part (C) → unkown solution: unknown (33)

① water hardness → $MV_{(EDTA)} = M\bar{V}_{CaCO_3}$

$\bar{V}_{EDTA} = \frac{V_1+V_2}{2} = \frac{36.40+37.7}{2} = 37.05 \pm 0.1$

$\hookrightarrow \sqrt{(0.07)^2+(0.07)^2}$

$\bar{V}_{CaCO_3} = 10.00 \pm 0.07$

$\hookrightarrow \sqrt{(0.05)^2+(0.05)^2}$

$$M_{CaCO_3} = \frac{5.30\times10^{-3} * 37.05\times10^{-3}}{10.00\times10^{-3}} = 0.0196\ M$$

$$ppm = 0.0196\ \frac{mol}{L} * \frac{100.086\ g}{mol} * 10^3\ \frac{mg}{g} = \boxed{1962.68\ \frac{mg}{L}}$$

② ppCa^{+2} → $MV_{EDTA} = M\bar{V}_{Ca^{+2}}$

$$M_{Ca^{+2}} = \frac{5.30\times10^{-3} * 28.95\times10^{-3}}{10.00\times10^{-3}}$$

$\bar{V}_{EDTA} = \frac{28.7+29.2}{2} = 28.95 \pm 0.1$

$\sqrt{(0.07)^2+(0.07)^2}$

$M_{Ca^{+2}} = 0.0153$

$$ppm = 0.0153 * 40.078 * 10^3\ \frac{mg}{g} = \boxed{614.93\ \frac{mg}{L}}$$

③ ppmMg^{+2} EDTA $\bar{V}$(corssponding to Mg^{+2}) = $37.05 \pm 0.1 - 28.95 \pm 0.1$

$= 8.10 \pm 0.14$

$\hookrightarrow \sqrt{(0.1)^2+(0.1)^2}$

$MV_{EDTA} = MV_{Mg^{+2}}$

$$M_{Mg^{+2}} = \frac{5.30\times10^{-3} * 8.10\times10^{-3}}{10.00\times10^{-3}} = 4.293\times10^{-3}\ M$$

$$ppm_{Mg^{+2}} = 4.293\times10^{-3} * 24.30\ \frac{g}{mol} * 10^3\ \frac{mg}{g} = \boxed{104.31\ \frac{mg}{L}}$$

$$ppm(Ca^{+2}+Mg^{+2}) = 614.93 + 104.31$$

$$= \boxed{719.24\ \frac{mg}{L}}$$

$\frac{10}{10}$

91

Experiment 10

Data Sheet and Calculations

Name: Majd emad Al-zoubi **Section:**

Reg. No.: 0222387 **Date:**

Unknown ID No.:	
Volume of solution used	10.00 ± 0.05
Mass of empty crucible	53.0457g ±0.0001
Mass of empty crucible +$Ni(DMG)_2$	53.1567g ±0.0001
Mass of $Ni(DMG)_2$ precipitate	0.111 ±0.0001
Mass of Ni	0.0226 ±0.0001
Mass of Ni per liter solution (mg/L)	2260

$\frac{mol}{L} \times$

Instructor's Signature:

Instructor's Name:

University of Jordan
Analytical Chemistry lab مجد عماد الزعبي Department of Chemistry

Quiz#3

Student Name (Arabic): Majd emad Al-zoubi St No. 0222387

A **0.5000 g** solid sample suspected of containing NaCl was dissolved in water. The entire solution was treated with **25.00 mL** of **0.1000 M AgNO₃** (excess) to precipitate chloride as AgCl. The excess Ag⁺ was then back-titrated with **0.1000 M KSCN**; the volume of KSCN required for the endpoint was **10.40 mL**. Calculate the **mass of NaCl** in the sample and the percent **(w/w) NaCl.** MM(NaCl)=58.443 g/mole

$Ag^+ + Cl^- \rightarrow AgCl(s)$

Excess $Ag^+ + SCN^- \rightarrow AgSCN(s)$

$MV_{(Ag^+)} = MV_{(Cl)} + MV_{(SCN)}$

$25 * 0.1 = n_{CL} + 0.1 * (10.40)$

$2.5 = n_{CL} + 1.04$

$\boxed{n_{CL} = 1.46} \text{ mol}$

8/10

$\rightarrow n = 1.46 \times 10^{-3}$

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

$m = 0.0853$

$n = \frac{mass}{mm}$

$mass = n \times mm$

$= 1.46 * 58.443$

$\boxed{mass = 85.326 \text{ g}}$ 0.0853 g

$perentge = \frac{0.0853}{0.5000 g} = 0.17 \times 100\%$

$= 17\%$

$percentage = \frac{mass \; NaCl}{mass \; all}$

$= \frac{85.326}{100} * 100\% = 85.326\%$

$\approx 85\%$

2) For Mohr's method

What is the titrant in the titration? AgNo₃ ✓

What is the Analyte in the titration? KCL ✓

What is the indicator? potasium chromate ✓

What is the medium (acidity)? Nuatral ✓

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Quiz#2

Student Name (Arabic): عجعار الزعبي

St number #: 0222387

1- In a standardization titration of hydrochloric acid (HCl) using 0.12 g of sodium carbonate (Na_2CO_3, 105.99 g/mol) as the primary standard, the student required **10.20 mL of HCl** to reach the endpoint. Calculate the concentration of the HCl solution in Molarity?

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

$MV_{HCl} = 2MV_{Na_2CO_3}$

HCl →

↳ V: 10.20mL

Na_2CO_3 $m = 0.12g$

$MM = 105.99 g/mol$

$n = \frac{m}{mm} = \frac{0.12}{105.99} = 1.132 \times 10^{-3}$

7/10

$V_{HCl} = V_{Na_2CO_3}$

2

$M = \frac{n}{V} = \frac{1.32 \times 10^{-3}}{10.20 \times 10^{-3}}$

$\boxed{M_{Na_2CO_3} = 0.1294 M}$

M*

$M_{HCl} = 2 \times M_{Na_2CO_3} = 0.258 M$

2- To determine the concentration of the unknown phosphoric acid (H_3PO_4) solution in this experiment, which two indicators were used?

phenolphthalene

Bromocresol green

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Quiz#4

Student Name (Arabic): Majd emad Al-zoubi

Student no. #: 0222387

Q1, 6 marks) A 50.0-mL tap water sample was diluted to 100 mL, and titration of this diluted port-tion required 10.20 mL of 0.100 M EDTA. Calculate the total hardness of the original tap water sample e, expressed as g/L of CaCO$_3$ (Molar mass of CaCO$_3$ = 100 g/mol).

$MV_{EDTA} = 10.20\,mL * 0.1 = 1.02\,M$

$MV_{EDTA} = MV_{CaCO_3}$

$1.02\times10^{-3} = M * 100\times10^{-3}$

$M_{CaCO_3} = 0.0102\,M$

$\frac{8}{10}$

$M_{CaCO_3}\ \frac{g}{L} = 0.0102\,\frac{mol}{L} * 100\,\frac{g}{mol} = \boxed{1.02\,\frac{g}{L}}$ x2

معامل التخفيف $\frac{100}{50} = 2$

$0.0102\,M \times 2 = 0.0204\,M$

$\frac{g}{L} \rightarrow 0.0204 \times 100\,\frac{g}{mol} = 2.04\,\frac{g}{L}$

What indicators are used in EDTA titrations for calcium and magnesium ions, and why is it necessary to use two different indicators?

Ca M

→ Erochrome black T

→ and Mureixde

using two indicaler becouse Mureixde it determine Ca^{+2} and the Erochrome black T → to determine $Ca^{+2} + Mg^{+2}$ and we use two indicalor be

becouse the variation value of pH

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مجد الزعبي

Quiz#1

Student Name (Arabic): Majd Al-zoubi **St number #:** 0222387

Q1) A 25.00 mL pipette was found to deliver **24.845 g of water** at **20.0 °C**. At this temperature, **1.0000 g of water occupies 1.0028 mL.**

a) Calculate the *actual volume* of water delivered by the pipette.

b) Find the *correction* to the expected 25.00 mL mark.

1g → 1.0028 mL

24.845g → ??

Actual volume = 24.9145 mL ✓

10/10

Correction = Actual volume - apperant volume

= 24.9145 - 25.00

= -0.0855

≈ -0.09 ✓

Q2) True or False:

1) Temperature affects the density of water, so it must be considered when converting mass to volume in a calibration experiment. True ✓

2) If the pipette gives less water than it should, then the correction is negative True ✓