GREENHILL ACADEMY –SECONDARY

S.5 CHEMISTRY PRACTICAL TERM III HOLIDAY WORK 2023

Instructions:

Print all this work

Answer **all** *the questions in the spaces provided*

QUANTITATIVE ANALYSIS –DRY RUN

1. You are provided with the following:

FA1, which is approximately a 1.0 **M** sodium hydroxide solution.

FA2, which is a 0.1**M** hydrochloric acid

FA3, which is a 0.02 **M** hydrochloric acid

Q, which is an acidic solid

You are required to determine the percentage of the acid in ***Q***

Procedure A

Pipette 25.0 or (20.0) cm^3 of **FA1** into a conical flask and titrate it with **FA2** using phenolphthalein indicator. Repeat the titration until you get consistent results. Record your results in **table A** below.

Results:

Volume of pipette used **20.0** cm^3

TABLE A

Final burette reading(cm^3)			
Initial burette reading (cm^3)			
Volume of FA2 used (cm^3)			

Titer values used for calculation of the average volume of **FA2**

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Average volume of **FA2** used = **15.60** cm^3

Question

Calculate the molar concentration of sodium hydroxide in **FA1**

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Procedure B

Weigh accurately 1.5 g of Q and transfer it to a conical flask containing about 25 cm^3 of
distilled water. Add 25 cm^3 of FA1 and boil the mixture gently for about l5minutes (add more water during the boiling to maintain the volume nearly constant if necessary). Cool and transfer the mixture into a 250 cm^3 volumetric flask. Dilute with distilled water to the mark. Label the solution **FA4.**

Pipette 25.0 or (20.0) cm^3 of **FA4** into a conical flask and titrate with **FA3**, using phenolphthalein indicator. Repeat the titration until you obtain consistent results. Record your results in the table **B** Below

Results

Volume of pipette used **………..** cm $^{\mathbf{3}}$

Table B

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **FA2** use (cm^3)			

Titre values used for calculation of the average volume of **FA2**

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Average volume of **FA2** used **13.30** cm^3

a) Calculate:

(i) The number of moles of excess sodium hydroxide that did not react with the acid in **Q**.

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(ii) The number of moles of sodium hydroxide that reacted with the acid in **Q**

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b) Determine

(i) The mass of the acid in Q that reacted with sodium hydroxide (Relative molecular mass of the acid in Q is 126. 1 mole of the acid in q reacts with 2 moles of sodium hydroxide)

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(ii) The percentage of the acid in Q

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2. You are provided with the following:

$\boldsymbol{BA1}$, which is potassium permanganate solution.

$\boldsymbol{BA2}$, which contains $11.5g$ of $FeSO_4.XH_2O$ in $500cm^3$ of solution

$\boldsymbol{BA3}$, which is $2M$ sulphuric acid.

Solid $\boldsymbol{W}$ which is sodium oxalate $(Na_2C_2O_4)$.

You are required to determine the:

(i) Concentration of potassium permanganate in $\boldsymbol{BA1}$ in $moldm^{-3}$.

(ii) Value of $\boldsymbol{X}$ in $FeSO_4.XH_2O$

$(Na = 23, C = 12, H = 1, Fe = 56, S = 32)$

Theory.

Manganate(VII) ions react with Fe^{2+} and ${C_2O_4}^{2-}$ according to the equation below.

$$MnO_4^-(aq) + 8H^+(aq) + 5Fe(aq) \rightarrow Mn^{2+}(aq) + 4H_2O(l) + 5Fe^{2+}(aq)$$

$$2MnO_4^-(aq) + 16H^+(aq) + 5C_2O_4^{2-}(aq) \rightarrow 2Mn^{2+}(aq) + 8H_2O(l) + 10\,CO_2(g)$$

Procedure I:

Weigh accurately $1.4g$ of $\boldsymbol{W}$ into a clean beaker. Add about $100cm^3$ of distilled water and shake well to dissolve. Transfer the solution into a $250cm^3$ volumetric flask and make up to the mark with distilled water. Label this solution $\boldsymbol{BA4}$.

Pipette $20cm^3$ (or $25cm^3$) of $\boldsymbol{BA4}$ into a clean conical flask. Add equal volume of $\boldsymbol{BA3}$ to the solution in the conical flask. Heat the mixture to about 60^oC and immediately titrate the hot solution with $\boldsymbol{BA1}$ from the burette until the end point is reached. Repeat the titration to obtain consistent results. Record your results in the table below:

Results:

Mass of beaker + $\boldsymbol{W}$ = ……………………………………….g

Mass of beaker = …………………………..……………g

Mass of $\boldsymbol{W}$ = ……………………..………………g

Volume of pipette used: ……………………**25.0**……………...cm^3

Table I

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of $\boldsymbol{BA1}$ used (cm^3)			

Values used to calculate average volume of $\boldsymbol{BA1}$

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Average volume of $\boldsymbol{BA1}$ used: …………………**23.30**…………cm^3.

Procedure II:

Pipette $20cm^3$ (or $25cm^3$) of $\boldsymbol{BA2}$ into a conical flask. Add equal volume of $\boldsymbol{BA3}$ to the solution in the conical flask. Titrate the mixture with $\boldsymbol{BA1}$ from the burette until the end point is reached. Repeat the titration to obtain consistent results. Record your results in the table below:

Volume of pipette used: ……………………………………………cm^3

Table II

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of $\boldsymbol{BA1}$ used (cm^3)			

Values used to calculate average volume of $\boldsymbol{BA1}$

…………………………………………………………………cm^3.

Average volume of $\boldsymbol{BA1}$ used: ………………**23.00**…..…………cm^3.

Questions:

(a) Calculate the concentration of

(i) sodium oxalate in $\boldsymbol{BA4}$ in moles per litre.

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(ii) potassium permanganate in $\boldsymbol{BA1}$ in moles per litre.

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(iii) $FeSO_4.XH_2O$ in $\boldsymbol{BA2}$ in moles per litre.

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(b) Determine the value of ***X*** in $FeSO_4.XH_2O$.

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INORGANIC QUALITATIVE ANALYSIS –DRY-RUN

1. You are provided with substance **Y**, which contains **two** cations and **two** anions. You are required to identify the cations and the anions in **Y.** Carry out the following tests on **Y** and identify any gas (es) evolved**.**

TESTS	OBSERVATION	DEDUCTIONS
(a) Heat one spatula end-full of **Y** strongly in a dry test tube until there is no further change.		
(b) Put **two** spatula end-fuls of **Y** in a boiling tube add about 5 cm^3 of water and shake well. Filter and keep both the filtrate and the residue. Divide the filtrate into **five** portion		
(i) To the **first** part of the solution add sodium hydroxide drop-wise until in excess.		.
(ii) To the **second** part of solution add ammonia solution drop-wise until in excess.		

(iii) To the **third** part of the acidic solution add 2-3 drops of potassium thiocyanate.		
(iv) To the **fourth** part of the solution add 2-3 drops of lead (II) nitrate		
(v) Carry out a test of your own to confirm the anion in the filtrate using the **fifth** part. -------------------------------------		
(c) Wash the residue with water and dissolve it in dilute HCl (aq).until there's no further change. Divide the solution into **three** parts.		
(i) To the **first** part of the solution, add sodium hydroxide drop- wise until in excess.		
(ii) To the **second** part of the solution, add ammonia solution drop- wise until in excess.		
(iii) Use the **third** portion add 2-3 potassium iodide solution		

Cations in **Y**: Co^{2+}, Cu^{2+} The anions in **Y**: $Cl^{-} and\ CO_3^{2-}$

2. You are provided with substance **T**, which contains **two** cations and **two** anions.
You are required to carry out the tests in Table **3** and identify the cations and the anions in **T**. Identify any gas(es) evolved.
Record your observations and deductions in the table.

Table 3 *(32 marks)*

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula end-ful of **T** strongly in a dry test tube.		
(b) To **two** spatula end-fuls of **T** in a boiling tube, add dilute nitric acid drop-wise until there is no further change. To the resultant solution, add dilute sodium hydroxide drop-wise until in excess. Shake and filter. Keep both the filtrate and residue.		
(c) To the filtrate, add dilute nitric acid a little at a time until the solution is just acidic. Divide the acidified filtrate into **four** parts.		

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the **first** part of the acidified filtrate, add 2 cm^3 of ethanol followed by 2-3 drops of concentrated sulphuric acid and warm the mixture.		
(ii) To the **second** part of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.		
(iii) To the **third** part of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.		
(iv) Use the **fourth** part of the acidified filtrate to carry out a test of your own choice to confirm **one** of the cations in **T**.		
(d) Dissolve the residue from (b) in dilute hydrochloric acid and divide the resultant solution into **four** parts.		

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the **first** part of the resultant solution, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the **second** part of the resultant solution, add dilute ammonia solution drop-wise until in excess.		
(iii) To the **third** part of the resultant solution, add 2-3 drops of potassium iodide solution.		
(iv) Use the **fourth** part of the solution to carry out a test of your own choice so as to confirm the **second** cation in **T**.		

(e) (i) The cations in **T** are ....and.......................................

(ii) The anions in **T** are......................................and ....

Zn^{2+} and Cu^{2+}

CH_3COO^- and CO_3^{2-}

ORGANIC QUALITATIVE ANALYSIS- DRY-RUN

1. You are provided with substance **E**, which is organic. Carry out the following tests to identify the nature of **E**. record your observations and deductions in the table below:

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of **E** on a spatula end or on a crucible lid.		
(b) To $1cm^3$ of **E** add 2 cm^3 of water, shake allow to stand, and then test with litmus paper.		
(c) To $1cm^3$ of **E** add half spatula of sodium carbonate.		
(d) To $1cm^3$ of E and $1cm^3$ of concentrated sulphuric acid and warm gently		
(e) To about 2 cm^3 ammoniacal silver nitrate solution add a few drops of E and warm gently.		

Comment on the nature of **E**: is **methanoic acid.**

2. You are provided with substance A, which is organic. Carry out the following tests to identify the nature of A. record your observations and deductions in the table below:

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of **A** on a spatula end or on a crucible lid.		
(b) To $1cm^3$ of **A** add 2 cm^3 of water, shake allow to stand, and then test with litmus solution.		
(c) To $1cm^3$ of **A** add $3cm^3$ of sodium carbonate solution and Warm		
(d) To $3cm^3$ of Brady's reagent add 2 drops of **A**.		
(e) To $2cm^3$ of **A** add 2-3 drops of potassium dichromate (VII) solution and heat gently. Divide the solution into 2 parts.		

(f) To the first part add 3-4 drops of Brady's Reagent.		
(g) To the second part add potassium manganate (VII) solution. Heat gently, shake and leave to stand.		
(h) To 4cm^3 of **A** add 3cm^3 of Iodine solution followed by drop wise addition of dilute sodium hydroxide solution until the brown colour just disappears warm gently and cool in ice-water bath.		

State the Identity of A**:** A is **ethanol**

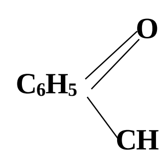
3. You are provided with substance D, which is organic. Carry out the following tests to identify the nature of D. record your observations and deductions in the table below:

TESTS	OBSERVATIONS	DEDUCTIONS
(a) To 2 cm^3 of water and 1 cm^3 of D, Shake and allow to stand		

(b) To 1cm^3 of compound D add 2-3 drops of potassium dichromate solution.		
(i) To about 0.5cm^3 of the compound D, add 2-3 drops of 2, 4-dinitrophenyl hydrazine solution.		
(ii) Dissolve 4 drops of compound D in about 1cm^3 of methanol followed by 1cm^3 of dilute sodium hydroxide solution, followed by iodine solution until in the iodine colour persists. Then warm and allow to stand	·	

Comment on the nature of compound D

The compound is an **aromatic carbonyl compound** with the structure



4. You are provided with substance G, which is organic. Carry out the following tests to identify the nature of A. record your observations and deductions in the table below

TESTS	**OBSERVATIONS**	**DEDUCTIONS**
(a) Burn a small amount of G on a spatula end		
(b) To 1cm^3 of compound G add 2cm^3 of water and shake. Test the solution with litmus paper.		
(c) Shake 2-3 drops of G with 1cm^3 of dilute Hydrochloric acid.		
(d) To 1 cm^3 of , drop wise add a few drops of bromine water		
(e) To 2cm^3 of dilute hydrochloric acid add a few drops of G. cool the test tube in ice-water bath and add 1cm^3 of sodium nitrite solution. Then add 1-2cm^3 of naphthalene 2-1 solution in sodium hydroxide solution.		

Functional group in G is: **Amino group (-NH2** G is: **A primary aromatic amine**