NAME;.....**SIGNATURE:**.....

P525/3
CHEMISTRY
(Practical)
Paper 3
Aug/Sept. 2024
3 $\frac{1}{4}$ hours.

INTERNAL MOCK EXAMS
2024

S6 CHEMISTRY PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS:

Answer **all** *questions. Use* **blue** *or* **black** *ink. Any work done in pencil will not be marked* **except** *drawings.*
Record your answers on this question paper in the spaces provided.
Mathematical tables and silent non-programmable scientific calculators may be used.

Reference books (i.e textbooks, booklets on qualitative analysis, etc) should **not** *be used.*

Candidates are not allowed to start working with the apparatus for the first **15 minutes**. *This time is to enable candidates read the question paper and make sure they have all the apparatus and chemicals that they may need.*

For Examiners' Use only			
Q.1	**Q.2**	**Q.3**	**Total**

1. You are provided with the following:

FA1, which is an aqueous solution of a strong acid, H_2X.

FA2, which is a solution containing 4.25 gl^{-1} of hydroxide ions, $\bar{O}H$.

FA3, which is a 0.04M solution of hydroxide ions.

Solid **Z** which is a basic compound.

You are required to determine the;

(i) concentration of FA1 in moles per litre

(ii) stoichiometric ratio of reaction between H_2X in FA1 and Z.

Theory;

Hydroxide ions react with hydrogen ions according to the following equation:

$$\bar{O}H(aq) + H^+(aq) \longrightarrow H_2O(l)$$

Procedure A;

(a) Using a measuring cylinder, transfer 40 cm^3 of **FA1** into a 250 cm^3 volumetric flask and make up to the mark with distilled water. Label the solution formed **FA4**.

(b) Pipette 20.0 (or 25.0)cm^3 of **FA2** into a clean conical flask, add 2-3 drops of phenolphthaein indicator and titrate it with **FA4** from the burette.

(c) Repeat the titration until you obtain consistent results.

(d) Record your results in **Table 1** below.

Results:

Table 1

Volume of pipette used;..... cm^3(½ mark)

Final burette reading(cm^3)			
Initial burette reading(cm^3)			
Volume of FA4 used(cm^3)			

(4 ½ marks)

Titre values used for calculating average volume of **FA4**. *(½ marks)*

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.....cm^3

Average volume of **FA4**

used..... cm^3 *(2 ½ marks)*

Question;

Calculate the;

(i) number of moles of H_2X in 250cm^3 of **FA4**. *(4 ½ marks)*

$(\boldsymbol{H = 1; O = 16})$

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(ii) concentration of H_2X in moles per litre of **FA1**. *(1 ½ marks)*

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Procedure B;

d) Weigh accurately about 2.5 g of **Z** into a clean beaker. Using a measuring cylinder, add to it 20.0cm^3 of **FA1** and stir to dissolve. Transfer the contents of the beaker into a 250 cm^3 volumetric flask and add more distilled water to top up to the mark. Label the resultant solution **FA5**.

e) Pipette 20.0 (or 25.0)cm^3 of **FA5** into a clean conical flask, add 2-3 drops of phenolphthalein indicator and titrate it with **FA3** from the burette.

f) Repeat the titration until you obtain consistent results.

g) Record your results in **Table 2** below.

Results: *(1 ½ marks)*

Mass of **Z** and weighing bottle:.....g

Mass of empty weighing bottle:.....g

Mass of **Z** used:.....g

Table 2

Results:

Final burette reading(cm^3)			
Initial burette reading(cm^3)			
Volume of FA3 used (cm^3)			

(4 ½ marks)

Record the titre values used to calculate average volume of **FA3** used……cm^3

(½ mark)

Average volume of **FA3**
used……cm^3

(2 ½ marks)

Questions:

(h) Calculate the number of moles;

(i) excess acid that reacted with hydroxide ions in **FA3**.

(1 ½ marks)

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(ii) excess acid in 250cm^3 of **FA5**. *(01 mark)*

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(iii) acid that reacted with ***Z***. *(02 marks)*

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(c) Determine the reaction ratio between H_2X and **Z**.

$(\boldsymbol{Relative\ formula\ mass\ of\ Z = 84})$

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2. You are provided with substance **X** which contains **three** cations and **one** anion. You are required to carry out the tests in Table **3** below to identify the anion and cations in **X**. Identify any gas(es) evolved. Record your observations and deductions in the table. *(30 marks)*

Table 3

	TEST	OBSERVATIONS	DEDUCTIONS
(a)	Heat a spatula endful of **X** in a dry test tube until there is no further change.		
(b)	Shake **two** spatula endfuls of **X** in a boiling tube with about $3cm^3$ of water. Add dilute sodium hydroxide solution to the mixture dropwise until in excess.		

	Warm and filter. Keep both the filtrate and residue.		
(c)	To the filtrate, add dilute nitric acid dropwise until the solution is just acidic. Divide acidic filtrate into **six** portions.		
(i)	To the **first** part of the filtrate, add sodium hydroxide solution dropwise until in excess.		
(ii)	To the **second** part of the acidified filtrate, add ammonia solution dropwise until in excess.		
(iii)	To the **third** part of the filtrate add 2-3 drops of dilute sulphuric acid.		
(iv)	To the **fourth** part of the filtrate, add 2-3 drops of litmus solution followed by ammonia solution dropwise until in excess.		
(v)	To the **fifth** part, add lead(II) nitrate solution and heat.		

(vi)	Use the **sixth** part of the acidified filtrate to carry out a test of your own to confirm the anion in **X**. **Test:**		
(d)	Wash the residue from part (b) with water and dissolve it dilute hydrochloric acid and divide the solution into **four** parts.		
(i)	To the **first** part add sodium hydroxide solution dropwise until in excess.		
(ii)	To the **second** part add dilute ammonia solution dropwise until in excess.		
(iii)	To the **third** part add, 4 drops of dilute hydrochloric acid, the 2 cm of magnesium ribbon and boil. Leave mixture to stand for 5 minutes. Then add potassium		

	hexacyanoferrate(III) to the resultant solution.		
(iv)	To the fourth part of the acidified filtrate, add 3-4 drops of potassium thiocyanate solution.		

(f) Identify the anion and cations in **X**

Anion; ……

Cations; …… , ... and.....

3. You are provided with organic substance **Y**. You are required to identify the nature of **Y**. carry out the tests below and record your observations and deductions. (20 marks)

	TESTS	**OBSERVATIONS**	**DEDUCTIONS**
(a)	Burn a small amount of **Y** in a porcelain dish or on a spatula end		
(b)	Shake 0.5 cm^3 of **Y** with about 1 cm^3 of water and test the resultant solution with litmus paper.		
(c)	To about 0.5cm^3 of **Y,** add neutral iron(III) chloride solution.		
(d)	To about 0.5cm^3 of **Y**, add a few drops of bromine water and shake.		
(e)	To about 0.5cm^3 of **Y**, add potassium dichromate		

	solution and heat.		
(f)	To about 0.5cm^3 of **Y**, add Lucas reagent.		
(g)	To about 0.5cm^3 of **Y**, add 2-3 drops of Brady's reagent		
(h)	To about 0.5cm^3 of **Y**, add 5 drops of concentrated sulphuric acid followed by a concentrated solution of sodium hydrogen sulphite and shake strongly.		
(i)	Dissolve about 0.5cm^3 of **Y** in about 1 cm^3 of methanol. To the resultant solution, add iodine solution followed by dilute sodium hydroxide solution dropwise until the solution is pale yellow. Warm the mixture and allow to stand.		

Comment on the nature of **Y**.

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END

CONFIDENTIAL

Each student is to be provided with;

- Volumetric flask **(250ml)**
- Burette
- Pipette (only 25.0cm^3)
- 2 conical flasks
- 8 test tubes
- 3 beakers (250ml each)
- 100 or 50ml measuring cylinder
- Distilled water
- 100 cm^3 of **FA1**
- 100 cm^3 of **FA2**
- 100 cm^3 of **FA3**
- 3.0g of solid **Z**
- 3.0g of solid **X**
- Phenolphthalein indicator
- A spatula
- 1 filter paper
- Litmus papers
- **Source of heat**
- **Weighing scale**
- 8 cm^3 of **Y**

FA1 is 1M sulphuric acid solution.

FA2 is 0.25M sodium hydroxide solution

FA3 is 0.041M sodium hydroxide solution.

Z is sodium hydrogen carbonate

X is a mixture of $Al_2(SO_4)_3$, $Fe_2(SO_4)_3$ (Ferric sulphate) and $(NH_4)_2SO_4$in a ratio 3:2:1

Y is **phenylmethylketone or phenylethanone**.