# KCSE FINAL PREDICTION

# CHEMISTRY PRACTICAL

## (PREDICTION TRIALS 1-10)

***An Exclusive Top-Notch KCSE Model Practical Questions.***

***A special preview of Possible Expected sample KCSE Practical Questions Most likely to be Tested in the Forthcoming KNEC Examinations.***

**SERIES 1**

***Proudly prepared by an Exceptional team of Experienced Veteran KNEC examiners within the National Group of Mwalimu Agency.***

*For Marking Schemes/Answers*

***0746 222 000***

# MWALIMU AGENCY

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 1 PRACTICAL

### Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

### INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

- About 60cm³ of solution P
- About 80cm³ of solution Q
- Accurately weighed 1.5g of solid R in a stoppered container.
- Solid H- about 0.5g in a stoppered container
- Solid G – about 0.5g in a stoppered container
- A burette
- A pipette and pipette filler
- Two conical flasks
- A 100ml plastic beaker
- A 250ml beaker
- Thermometer
- One stop watch
- 5 test-tubes
- One boiling tube
- 100ml measuring cylinder
- A small piece of aluminium foil
- A spatula
- Red and blue litmus paper
- Universal indicator paper and PH chart
- Test tube holder

- Filter paper
- Filter funnel

**Access to**

- 2M sodium hydroxide solution
- 2M ammonia solution
- Distilled water
- Phenolphthalein indicator
- Source of heat
- Acidified potassium dichromate (vi)
- Acidified potassium manganate (vii)
- Lead (ii) nitrate solution
- Potassium iodide solution

**Preparations**

- Solution P is 2M dilute hydrochloric acid
- Solution Q is 0.6M sodium hydroxide solution
- Solid R is accurately weighed 1.5g of sodium hydrogen carbonate solid
- Solid H is lead (ii) nitrate solid
- Solid G benzoic acid

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 1 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

### FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

# QUESTIONS

**1.** You are provided with:

- 1.5 g of solid R
- Solution P which is dilute hydrochloric acid
- Solution Q that was made by dissolving 12g of sodium hydroxide in 500cm³ of water

You are required to:

**i)** Calculate the molar enthalpy change for the reaction between solid R and dilute hydrochloric acid.

**ii)** Standardize hydrochloric acid solution P using sodium hydroxide solution Q.

## PROCEDURE 1

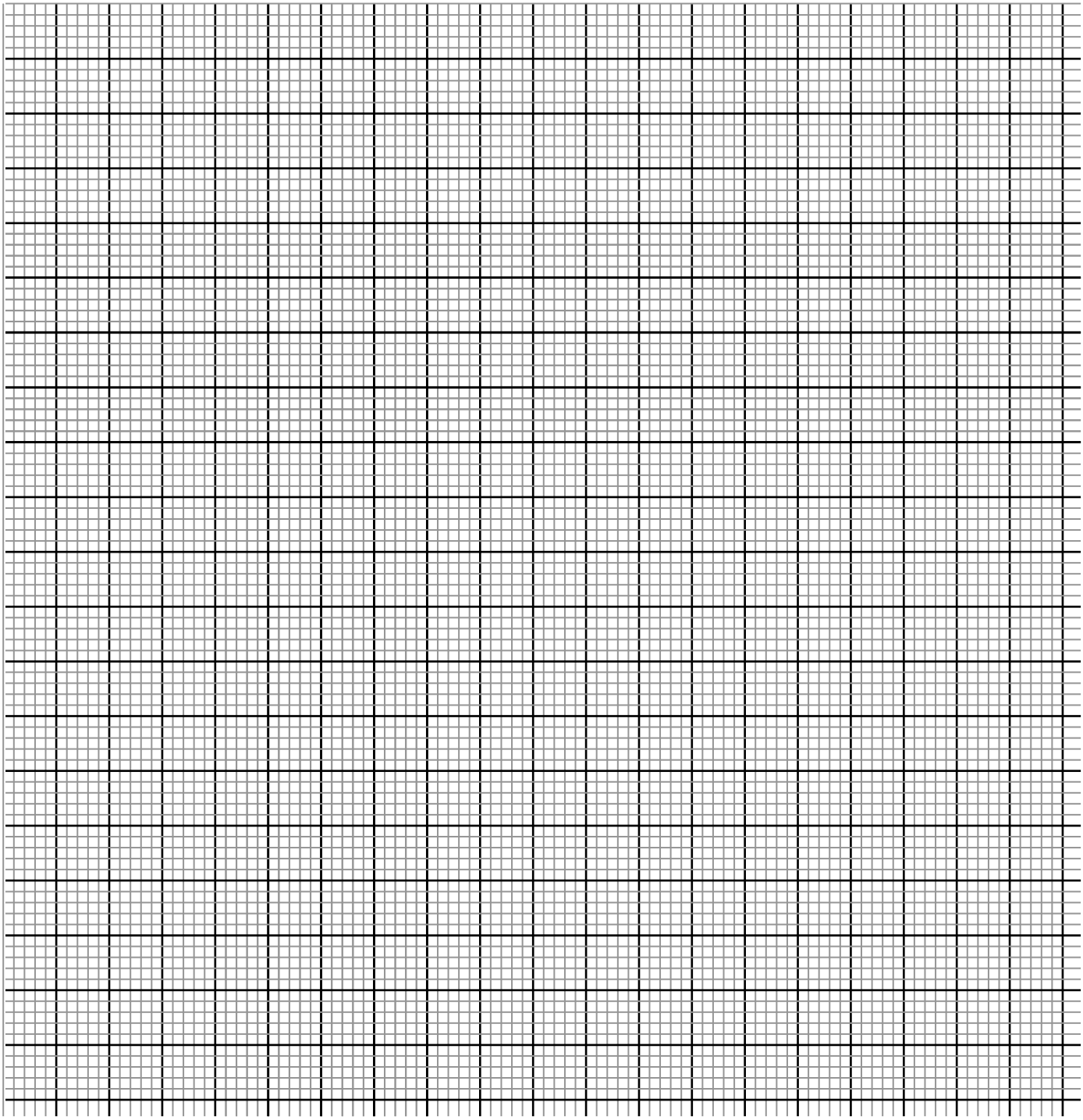
Using a clean burette, transfer 50cm³ of solution P into a clean 100ml plastic beaker. Measure the temperature of solution P for every ½ minute up to 1 minute and record your results in table 1.

At exactly 1½ minutes add all solid R at once stir the mixture carefully with the thermometer. Measure the temperature of the solution after every ½minute up to 5$^{th}$ minute. Record your results in table 1 below.

**(RETAIN THIS SOLUTION FOR USE IN PROCEDURE II)**

**Table 1** **(3mks)**

| Time (min) | 0 | ½ | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature ($^0$c) | | | | X | | | | | | | |



**(a)** Draw a graph of temperature against time in the grid provided below **(3mks)**

**b)** From the graph, calculate the temperature change for the reaction. **(1mk)**

**c)** Calculate the energy change for the reaction between solid R and dilute hydrochloric acid. **(S.H.C= 4.2J/g/k, density = 1g/cm$^3$)** **(1mk)**

**d)** Determine the enthalpy change for the reaction between one mole of solid R and dilute hydrochloric acid solution P. (RFM of solid R=84) **(1½mks)**

## PROCEDURE II

Transfer all the solution formed from procedure I into a clean 250ml beaker. Using a measuring cylinder add 50cm$^3$ of distilled water to the solution and swirl. Label this solution as solution R. Empty the burette and rinse it with distilled water. Fill the burette with solution R. Using pipette filler, pipette 25cm$^3$ of sodium hydroxide solution Q into a clean conical flask. Titrate solution R against solution Q using phenolphthalein indicator. Record your results in table II. Repeat the titration two more times and complete table II below.

**Table II** **(4mks)**

| Final burette reading cm$^3$ | I | II | III |
|---|---|---|---|
| Initial burette reading cm$^3$ | | | |
| Volume of solution R used cm$^3$ | | | |

**e)** Calculate the average volume of solution R used. **(1mk)**

**f)** Calculate the concentration of sodium hydroxide solution Q in moles per litre. **(Na = 23 O = 16 H=1).** **(1mk)**

**g)** Calculate the number of moles of:

**i)** Solution Q that reacted with solution R. **(1mk)**

**ii)** Hydrochloric acid in 100cm³ of solution R prepared. **(1mk)**

**iii)** Given that 1 mole of solid R reacts with 1 mole of hydrochloric acid, calculate the number of moles of hydrochloric acid in the original 50cm³ of solution P used. **(1½mks)**

**h)** Calculate the molarity of solution P in moles per litre. **(1mk)**

**2.** You are provided with solid H. carry out the experiments below, write your observations and inferences in the spaces provided.

a) Place all of the solid H in a boiling tube add 15cm³ of distilled water and shake well.

i) To about 2cm³ of solution formed add sodium hydroxide solution drop wise until excess.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

**ii) )** To about 2cm³ of solution formed add ammonia solution drop wise until excess.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

**iii)** To about 2cm³ of solution formed add 2 drops of lead (II) nitrate solution.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(2mk)** |

**iv)** To about 2cm³ of solution formed add 2 drops of potassium iodide solution.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

**v)** To about 2cm³ of solution formed add 2cm³ of sodium hydroxide solutions followed by a small piece of aluminium foil. Warm the mixture and test any gases produced with both blue and red litmus paper.

| Observations | Inferences |
|---|---|
| **(2mk)** | **(1mk)** |

**3.** You are provided with solid **G**. carry out the tests below. Write your observations and inferences in the spaces provided.

a) Scoop one third of solid **G** using a spatula. Heat the solid in a non-luminous flame.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

b) Place the rest of solid G in a boiling tube. Add about 10cm³ of distilled water. Filter the mixture.

i) To about 2cm³ of filtrate add 2 drops of acidified potassium manganate (vii) solution.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

b) ii) To about 2cm³ of filtrate add 2 drops bof acidified potassium dichromate (VI) solution.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

**iii)** Dip a universal paper to the remaining filtrate.

| Observations | Inferences |
|---|---|
| **(1mk)** | **(1mk)** |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 2 PRACTICAL

## Confidential

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## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

**(a)**

1. Burette
2. Pipette
3. Pipette filler
4. Filter funnel
5. White tile
6. Clamp and stand
7. **2** conical flask
8. **100 $cm^3$**glass Beaker (empty)
9. Stop watch
10. **100cm3** measuring cylinder
11. **10$cm^3$**measuring cylinder
12. **250 $cm^3$**volumetric flask
13. Metallic spatula
14. **6** clean test tubes
15. Test tube holder
16. **500ml** distilled water
17. White piece of paper or filter paper
18. **1** filter paper
19. **1** labelling paper
20. Phenolphthalein indicator

21. About **90cm$^3$** solution **K**
22. About **100cm$^3$** solution **L**
23. About **70cm$^3$** solution **N**
24. About **90cm$^3$** solution **P**
25. About **0.5g$NaHCO_3$**
26. About **1.0g** solid **Q**
27. About **0.5g** solid **R**

**(b) Each student should have access to the following solutions:**

1. Mean of heating
2. 2M NaOH
3. 2M $HNO_3$
4. $Pb(NO_3)$
5. Acidified $KMNO_4$
6. Potassium iodide solution

**NB: The above solutions should be supplied with a dropper each.**

**(c) <u>SOLUTIONS PREPARATION AND SOLID MEASUREMENTS</u>**

1. SOLUTION **K** IS **1M $H_2SO_4$**
2. SOLUTION **L** IS **0.36 M NaOH** CONTAINING **14.4g** OF **NAOH** IN **1 LITRE** OF THE SOLUTION
3. SOLUTION N IS **2M HCl**
4. SOLUTION P IS **0.16 M $Na_2S_2O_3$**(***SODIUM THIOSULPHATE***)
5. SOLID Q IS A MIXTURE OF SODIUM SULPHITE(**$Na_2SO_3$**) AND LEAD (II) CARBONATE (**$PbCO_3$**) MIXED IN THE **RATIO 1:1 (*should be thoroughly mixed*)**
6. SOLID **R** IS MALEIC ACID

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 2 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
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|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

## QUESTION 1

- You are provided with solution **K** and **L**
- **S**olution **K** is 1M $H_2SO_4$
- Solution **L** contains 8.7g of the hydroxide of metal **M** {with formulae MOH] in 600$cm^3$ of the solution
- You are required to carry out the experiment to determine;
    i. Concentration of solution L
    ii. R.A.M of metal **M**

## Procedure

1. Measure 75cm3 of solution K and put into a clean 250cm3 volumetric flask and add distilled water up to the mark
    -label this solution **W**
2. Fill a clean burette with solution W
3. Pipette 25cm3 of solution L into a clean conical flask and add 2 drops of phenolphthalein indicator
4. Titrate the solution **W** in the burette against solution **L** in the conical flask and record the results in the table below
5. Repeat {3} and {4} above as you fill the table below.

**TABLE 1**

| | I | II | III |
|---|---|---|---|
| Final burette reading {$cm^3$} | | | |
| Initial burette reading {$cm^3$} | | | |
| Volume of solution W used {$cm^3$} | | | |

**[4mks]**

**{a}**Calculate the;

**{i}**Average volume of solution W used **[1mk]**

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……

……

**{ii}** Concentration of solution W **[1mk]**

……

……

……

**{iii}** Number of moles of solution W that reacted with each 25cm3 portion of solution L **{2mks]**

……

……

……

……

**{b}** Calculate the;

{i} Number of moles of the metal hydroxide {MOH} in solution L that reacted with each portion of solution W **[2mks]**

……

……

……

……

**{ii}** Concentration of solution L **[1mk]**

……

……

……

**{iii}**Number of moles of the metal hydroxide [MOH]in 600cm3 of solution L **[2mks]**

……

……

……

……

**{iv}** R.A.M of metal M [0=16, H=1] **[2mks]**

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## QUESTION 2

You are provided with solution N and P

- Solution N is 2M HCl
- Solution P is 0.16M sodium thiosulphate
- You are required to carry out the experiment below to determine how concentration affects the rate of reaction between HCl and sodium thiosulphate solutions

### PROCEDURE

1. Fill a clean burette with solution P.
   Measure 25cm$^3$ of the solution P from the burette into a clean 100cm$^3$ glass beaker and place on a white piece of paper with a cross[x] marked on it
2. Add 10cm$^3$ of solution N into it and immediately start a stop watch and note the time taken for the cross beneath the mixture to become invisible
3. Clean the 100cm$^3$ beaker and measure into it 20cm$^3$ of solution P form the burette, and add 5cm$^3$ of distilled water into the solution solution
4. Repeat step [2] above and note the time taken for the cross to become invisible
5. Repeat the experiment using volumes indicated on the table below and as you record the results

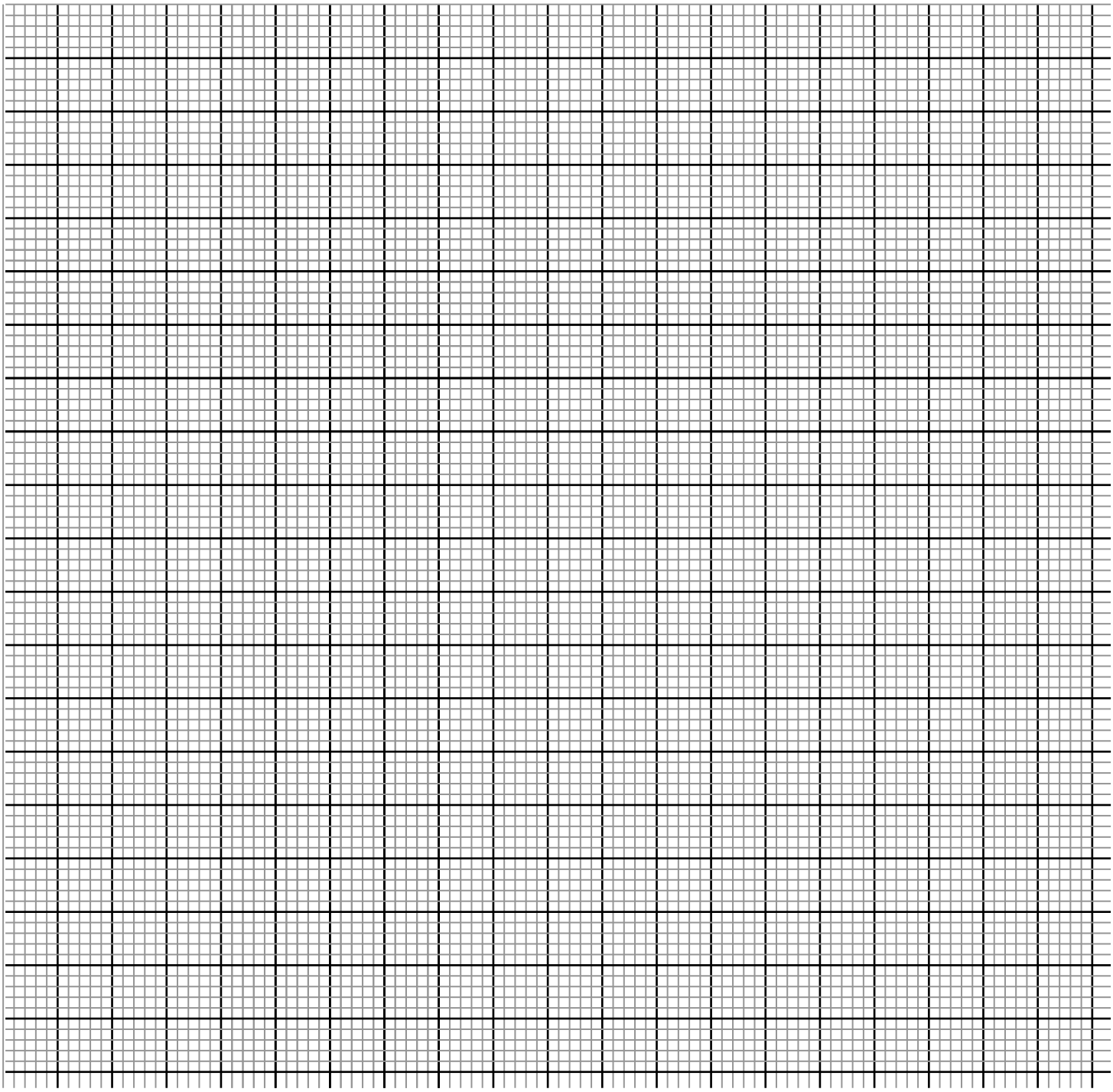
### TABLE 2

| Expt | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Volume of solution p(cm$^3$) | 25 | 20 | 15 | 10 | 5 |
| Volume of water added to solution p{cm3} | 0 | 5 | 10 | 15 | 20 |
| Volume of solution N | 10 | 10 | 10 | 10 | 10 |
| Time taken for the cross to become invisible [in seconds] | | | | | |
| $\frac{1}{t}$ S$^{-1}$ | | | | | |

(4mks)

**[a]** plot a graph of $\frac{1}{t}$ against volume of solution P on the grid provided

**[3mk]**



**{b}** From the graph

{i} Determine the time taken for the cross to become invisible when $12.5cm^3$ of solution P is used **[2mks]**

……

……

……

……

**{ii}** Explain the effect of concentration on the rate of reaction between HCl and sodium thiosulphate solution **[2mks]**

……

……

……

……

## QUESTION 3

- You are provided with solids Q and R
- You are required to carry out the tests below as you record your observations and inferences

**(i) SOLID Q**

-Add about $5cm^3$ of distilled water to solid Q, shake the mixture thoroughly for a while and then filter it

**NOTE**: Retain both the filtrate and the residue for the tests below

| | TEST | OBSERVATIONS | INFERENCES |
|---|---|---|---|
| (a){i} | Divide the filtrate into 4 portion<br>-To the first portion, add 4 drops of NaOH | $\left(\frac{1}{2}mark\right)$ | $(1mark)$ |
| {ii} | Scoop the 2nd portion on a metallic spatula and ignite on a non-luminous flame | $\left(\frac{1}{2}mark\right)$ | $\left(\frac{1}{2}mark\right)$ |
| {iii} | To the 3rd portion, add 2 drops of $Pb\{NO_3\}_{[aq]}$ | $\left(\frac{1}{2}mark\right)$ | $(1mark)$ |

| | | | |
|---|---|---|---|
| {iv} | To the 4th portion ,add acidified $KmnO_4$ | $\left(\frac{1}{2}mark\right)$ | $\left(\frac{1}{2}mark\right)$ |
| b{i} | Put the residue in a test tube and add about $2cm^3$ of $HNO_3$ | $\left(\frac{1}{2}mark\right)$ | $(1mark)$ |
| {ii} | To the mixture in b{i} above, add 2 drops of KI solution | $\left(\frac{1}{2}mark\right)$ | $\left(\frac{1}{2}mark\right)$ |

{**ii}SOLID R**

| | **TEST** | **OBSERVATIONS** | **INFERENCES** |
|---|---|---|---|
| (a) | Scoop a portion of solid R on a Metallic spatula and burn on a Non-luminous flame | $(1mark)$ | $(1mark)$ |
| (b){i] | Put the remaining portion of solid R into a clean test tube and add about $3cm^3$of distilled water, shake | $(1mark)$ | $\left(\frac{1}{2}mark\right)$ |

| | | | |
|---|---|---|---|
| | and divide into 2 portions | | |
| {ii} | To the 1st portion, add 2 drops of acidified $KMnO_4$ and warm | $\left(\frac{1}{2}mark\right)$ | $(1mark)$ |
| {iii} | To the 2nd portion add $NaCO_3$ | $\left(\frac{1}{2}mark\right)$ | $(1mark)$ |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 3 PRACTICAL

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### INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

**APPARATUS**

1. $100cm^3$of solution A, 0.02M $KMnO_4$.
2. $100cm^3$of solution B, 0.06 M ammonium iron(II)sulphate, $(NH_4)_2Fe(SO_4)_2.6H_2O$
3. $100cm^3$ of Solution C, 0.04M oxalic acid
4. 1 g Solid M, aluminium sulphate.
5. 0.5g solid P, oxalic acid in a stoppered container
6. Burette
7. Pipette and pipette filler.
8. 2 conical flasks
9. Clamp, boss and stand.
10. 1 boiling tube.
11. 5 clean test tubes
12. Distilled water in wash bottle.
13. Clean Metallic spatula
14. Bunsen burner.
15. PH chart
16. Universal indicator solution.
17. Red and blue litmus paper.

**COMMON REAGENTS**

1. 0.2M Sodium hydroxide, NaOH solution with a dropper.
2. Ammonia solution with a dropper.

3. Barium nitrate solution, $Ba(NO_3)_2$ with a dropper.
4. Dilute Nitric (V)acid solution with a dropper
5. Acidified potassium manganate (VII)solution with a dropper.
6. Bromine water with dropper.
7. Sodium chloride solution with a dropper.

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 3 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
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|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

1. **You are provided with**:
   - Acidified aqueous potassium manganate(VII), $KMnO_4$, solution A,.
   - Solution B containing 11.75g of ammoniumiron(II)sulphate, $(NH_4)_2Fe(SO_4)_2.6H_2O$ dissolved in 500 $cm^3$of solution.
   - Solution C containing 1.25g of a dibasic acid, $H_2X.\ 2H_2O$ dissolved in 250$cm^3$ of solution.

**You are required to:**
- Standardize solution A using solution B.
- Use the standardized solution A to determine the concentration of solution C.
- Determine the molecular mass of X.

**Procedure I:**

Fill the burette with solution A.Using a pipette and pipette filler, place 25 $cm^3$of solution B into a 250 ml conical flask. Titrate solution A with B until a permanent pink colour just appears.Record your results in table 1 below. Repeat this procedure two more times and complete table 1.

**TABLE 1**

| Titration | I | II | III |
|---|---|---|---|
| Final burette reading, $cm^3$ | | | |
| Initial burette reading, $cm^3$ | | | |
| Volume of solution A used, $cm^3$ | | | |

**(4 marks)**

**(a)** Calculate the average volume of solution A used. **(1 mark)**

**(b)** Calculate the concentration of B in moles per litre. (RFM of B is 392) **(1 mark)**

**(c)** Calculate the number of moles of iron (II)ions in the 25 $cm^3$ of solution B. **(1 mk)**

**(d)** Calculate the concentration of manganate(VII)ions in solution A in moles per litre given: **(1 mk)**

$$MnO_4^-(aq) + 5Fe^{2+}(aq) + 8H^+(aq) \rightarrow Mn^{2+}(aq) + 5Fe^{3+}(aq) + 4H_2O(l)$$

## PROCEDURE II:

Pipette 25 $cm^3$ of solution C into a conical flask. Heat this solution to about 70 $^0C$ and titrate the hot solution C with solution A in the burette until a permanent pink colour just appears. Shake thoroughly during titration. Record your results in table II. Repeat this procedure to complete table II.

## TABLE 1I

| Titration | I | II | III |
|---|---|---|---|
| Final burette reading, $cm^3$ | | | |
| Initial burette reading, $cm^3$ | | | |
| Volume of solution A used, $cm^3$ | | | |

**(4 mks)**

**(e)** Calculate the average volume of solution A used in table II.. **(1 mk)**

**(f)** Calculate the number of moles of manganate (VII) ions in table II above. **(1 mk)**

**(g)** Given that 2 moles of of manganate (VII) ions react with 5 moles of the dibasic acid C, calculate the number of moles of the dibasic acid used in moles per litre. **(1 mk)**

**(h)** Calculate the:

(I) Formula mass of the dibasic acid, solution C.(H = 1.0, O = 16.0) **(1 mk)**

(II) Formula mass of X in the dibasic acid C**.** **(1 mk)**

**2.** You are provided with solid M. Carry out the tests and write your observations and inferences in the spaces provided.

**(a)** Describe the appearance of solid P. **(1 mark)**

| Appearance |
|---|
| |

**(b)** Place the solid M in a boiling tube. Add about $12cm^3$ of distilled water and Shake well.Divide the solution into five portions and carry out the tests below.

**(I)** To the first portion, dip both red and blue litmus paper.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**(II)** To the second portion, add sodium hydroxide solution dropwise until in excess.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**(III)** To the third portion, add aqueous ammonia dropwise until in excess.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**(IV)** To the fourth portion, add three drops of sodium chloride solution.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**(V)** To the fifth portion, add two drops of barium nitrate followed by five drops of nitric(V) acid.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**3.** You are provided with solid P. Carry out the following tests and record your observations and inferences in the spaces provided.

**(a)** Place about one third of the solid P on a clean metallic spatula and ignite using a Bunsen burner.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**(b)** Place the remaining solid P in a boiling tube. Add about $10cm^3$ of distilled water and Shake well.

| Observations | Inferences |
|---|---|
| ( 1/2mark) | (1/2 mark) |

**(c)** Divide the mixture into three portions.

**i.** To the first portion add two drops of acidified potassiummanganate(VII).

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**ii.** To the second portion, add two drops of bromine water.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

**iii.** To the third portion, describe the procedure you can use to determine the PH using the reagents given.

| Procedure: |
|---|
| (1 mark) |

**iv.** Carry out your procedure in (iii) to determine the PH.

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 4 PRACTICAL

## Confidential

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## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

***Each candidate will require***

1. Solution B about 60 $cm^3$ of 1.1 M hydrochloric acid solution.
2. Solution C about 100 $cm^3$ of 0.2M sodium hydroxide solution.
3. One 250 ml volumetric flask.
4. One 100 ml measuring cylinder
5. 50 ml Burette
6. 25ml pipette.
7. 2 conical flasks
8. Retort stand
9. Filter funnel
10. 2.5g of solid F
11. 500ml of distilled water
12. 100ml plastic beaker
13. Thermometer
14. 1 spatula-ful of solid D
15. ½ spatula of solid E
16. Six test tubes in a rack
17. Red litmus paper
18. Blue litmus paper
19. Metallic spatula
20. 1 lable

## *ACCESS TO*

- 1M NaOH
- 1M $NH_4OH$
- Barium chloride soln. ($BaCl_2$)
- 0.5M NaCl
- Universal indicator soln.(pH 4 to 11)
- Sodium carbonate solid
- $KmnO_4$.
- Phenolphthalein indicator
- Source of heating

**NOTES**

1. Solid A — Exactly 0.31 of Zinc carbonate.
2. Solid D-Aluminium Sulphate
3. Solid E-Maleic acid
4. Solid F-anhydrous sodium carbonate
5. $BaCl_2$-dissolve 4g of solid in $1dm^3$ of solution.

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 4 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

### FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**1 You are provided with**

- Solid **A**: 0.31 g of a carbonate ($MCO_3$).
- Solution **B**: l.1M hydrochloric acid
- Solution **C:** 0.2M sodium hydroxide.
- Phenolphthalein indicator.

**You are required to:**

(i) Determine the molar mass of the carbonate

(ii) Determine the relative formula mass and hence formula of the carbonate.

**PROCEDURE**

- Measure 50 $cm^3$ of solution **B** using a measuring cylinder. Transfer the entire solid A provided into a 250$cm^3$ volumetric flask. Transfer 50 $cm^3$solutions B into 250$cm^3$volumetric flask containing solid **A** and swirl the contents until the entire Solid dissolves and no more effervescence occurs. Add more distilled water up to the 250$cm^3$ mark and label this solution **D**.
- Pipette 25.0$cm^3$ of solution **D** and transfer to a conical flask. Add two drops of phenophthalein indicator and titrate with solution **C**from the burette. Record your results in table I below.
- Repeat the titration to get two more concordant values.

**TABLE 1**

| | I | II | III |
|---|---|---|---|
| Final burette reading ($cm^3$) | | | |
| Initial burette reading ($cm^3$) | | | |
| Volume of C used ($cm^3$) | | | |

**(4 mks)**

**(a)** Calculate;

(i) The average volume of solution **C** used. **(1mk)**

**(ii)** The moles of solution **C** in the volume in (i) above. **(1mk)**

**(iii)** The moles of **D** that reacted with **C**. **(1mk)**

**(iv)** The moles of hydrochloric acid in 250 $cm^3$ of solution D **(1mk)**

**(v)** The moles of hydrochloric acid in 25$cm^3$ of B. **(1mk)**

**(vi)** Calculate the moles of HCl which reacted with the carbonate (1mk.. **(1mk)**

**(vii)** Calculate the moles of the carbonate that reacted with the acid **(1mk)**

**(viii)** Determine the relative formula mass of the carbonate and the value of M **1mks**

**2)** You are provided with 2.5g of a hydrous sodium carbonate labeled F. You are required to determine the enthalpy of solution of solid F.

## Procedure

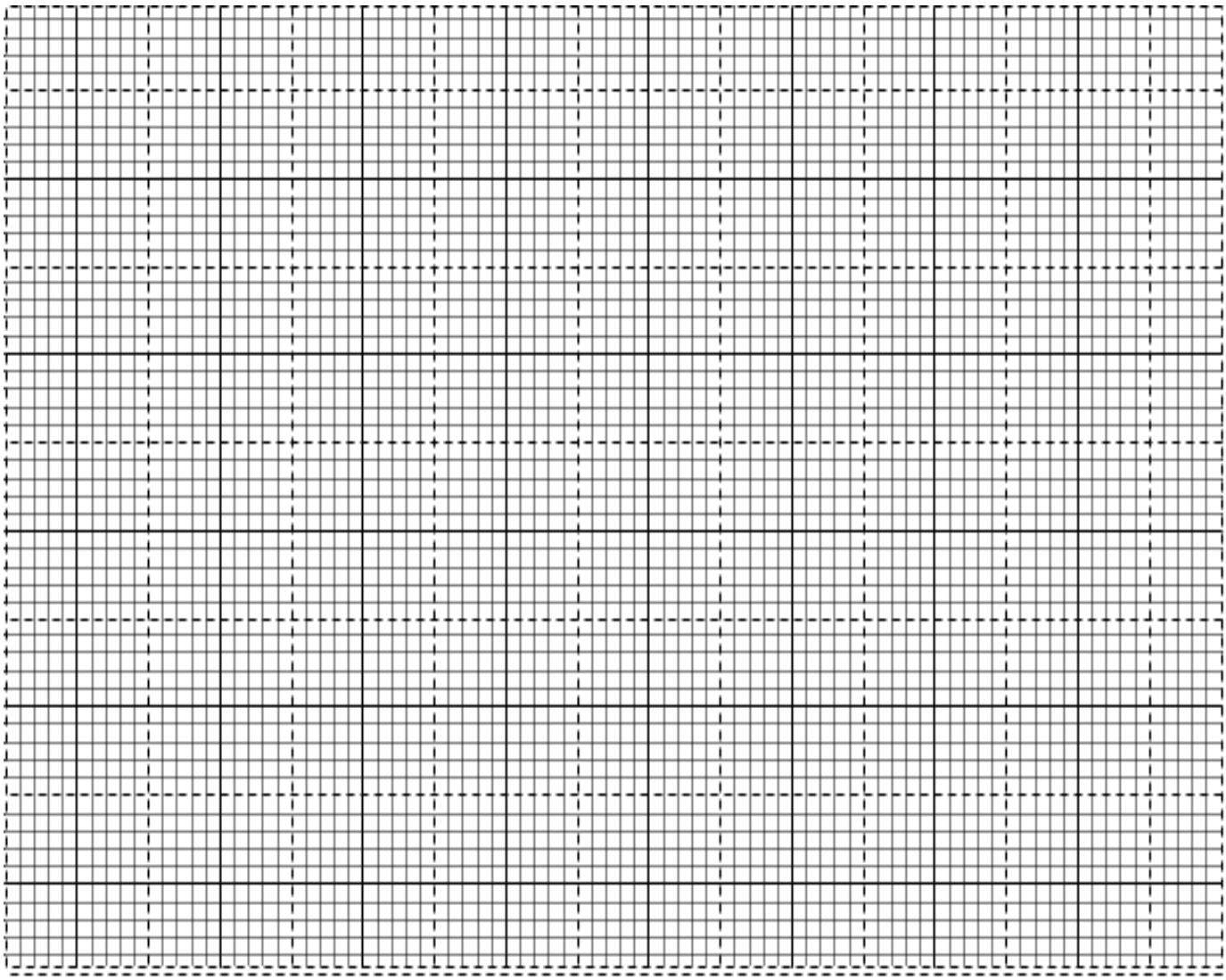
Using 50m1 measuring cylinder place 25cm$^3$ of water into l00ml plastic beaker. Stir the water gently with a thermometer and take its temp after every half-minute. Record the reading in the table below. At exactly 2 minutes add all solid F to the water at once. Stir well with the thermometer as you take the temperature ofto the mixture after every half- minute upto the 4$^{th}$minute.

**Table III**

| **Time (min)** | **0** | **½** | **1** | **1 ½** | **2** | **2 ½** | **3** | **3 ½** | **4** |
|---|---|---|---|---|---|---|---|---|---|
| **Temp $^oC$** | | | | | | | | | |

**3mks**

(a) On the grid provided plot a graph of temp against time. **(3mks**



**(b)** From the graph determine the change in temp (ΔT) **( 1mk)**

**(c) (i)** Calculate the number of moles of solid F used in the experiment (Na= 23,C=12, 0=16) **(1mk)**

**(ii)** Calculate the molar enthalpy of solution. (Density of solution $lgcm^{-3}$, specific heat capacity of solution is $4.2Jg^{-1}K^{-1}$ **(2mks)**

**3).** You are provided with solid D. Carry out the following tests and write down all the observations and Inferences.

**(a)** Place a half spatulafull of solid in a dry test tube and heat gently then strongly.Test any gas produced using red and blue litmus papers.

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1mk) |

**(b)** Place the remaining solid D in a boiling tube and add about $10cm^3$ of water shake Vigorously then divide the mixture into four portions.

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1mk) |

**(c)** To the 1st portion add four drops of barium chloride solution

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1mk) |

**(d)** To the 2nd portion add sodium hydroxide solution drop wise till in excess.

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | (1 mk) |

**(e)**To the third portion add aqueous ammonia solution drop wise till excess about $1cm^3$

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1 mk) |

**(f)** To the fourth portion add 3 drops of sodium chloride

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1mk) |

**II.** You are provided with substance E. Carry out tests on it.

(i) Place about one third of solid E on a metallic spatulaand ignite it in a flame.

| **Observations** | **Inferences** |
|---|---|
| ( 1mk) | ( 1mk) |

**(ii)** Place the remaining solid E boiling tube add about 5 $cm^3$ of distilled water. Shake the contents and divide into 3 portions.

**(a)** To portion one add 3 drops of Universal indicator

| **Observations** | **Inferences** |
|---|---|
| ( ½ mk) | ( ½ mk) |

**(b)** To second portion all sodium carbonate provided

| **Observations** | **Inferences** |
|---|---|
| ( ½ mk) | ( ½ mk) |

**(c)**To third portion add 2 drops of acidified potassium manganate (VII) solution. Warm the mixture

| **Observations** | **Inferences** |
|---|---|
| ( ½ mk) | ( ½ mk) |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 5 PRACTICAL

### Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

### INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

1. About 100 ml of solution L- 0.2 M NaOH
2. Distilled water in a wash bottle
3. Burette
4. Pipette and pipette filler
5. 2 conical flasks
6. 10 ml measuring cylinder
7. 250 ml volumetric flask
8. Exactly 3.6g of solid P- oxalic acid
9. Means of labelling- 1 piece
10. Test-tube holder
11. Thermometer(-10 to 110$^{o}$C)
12. Boiling tube
13. 5 Test tubes
14. Glass rod
15. Aluminium Foil
16. Red and Blue litmus papers
17. Ethanol labelled Liquid Q
18. Universal indicator and universal chart paper
19. Watch glass
20. Wooden splint
21. Solid Barium Nitrate labelled solid E

**ACCESS TO**:

Source of heat.

Phenolphthalein indicator.

NaOH.

Dilute $H_2SO_4$.

$Pb(NO_3)_2$ Solution.

Acidified $K_2Cr_2O_7$.

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 5 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

### FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

1. You are provided with;
   - 3.6 g of solid P in a boiling tube. Solid P is a hydrated dibasic acid with the formula $H_2C_2O_4.nH_2O$
   - Solution L which is a 0.2 M sodium hydroxide solution. You are required to determine;

   (i) Solubility of solid P

   (ii) The value of n in the formula $H_2C_2O_4.nH_2O$

**Procedure I**

I. Using a burette, add 4$cm^3$ of distilled water to solid P in the boiling tube. Heat the mixture while stirring with the thermometer to about 70 ºC. When all of solid has dissolved, allowthe solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid P first appear. Record the temperature in **table 1** below.

II. Using the burette, add 2 $cm^3$ of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves again. Allow the mixture to cool while stirring. Note the temperature at which crystals of solid P appears.

III. Repeat procedure (II) three more times and record the temperatures in **table 1**. **RETAIN the contents of the boiling tube for use in PROCEDURE II**

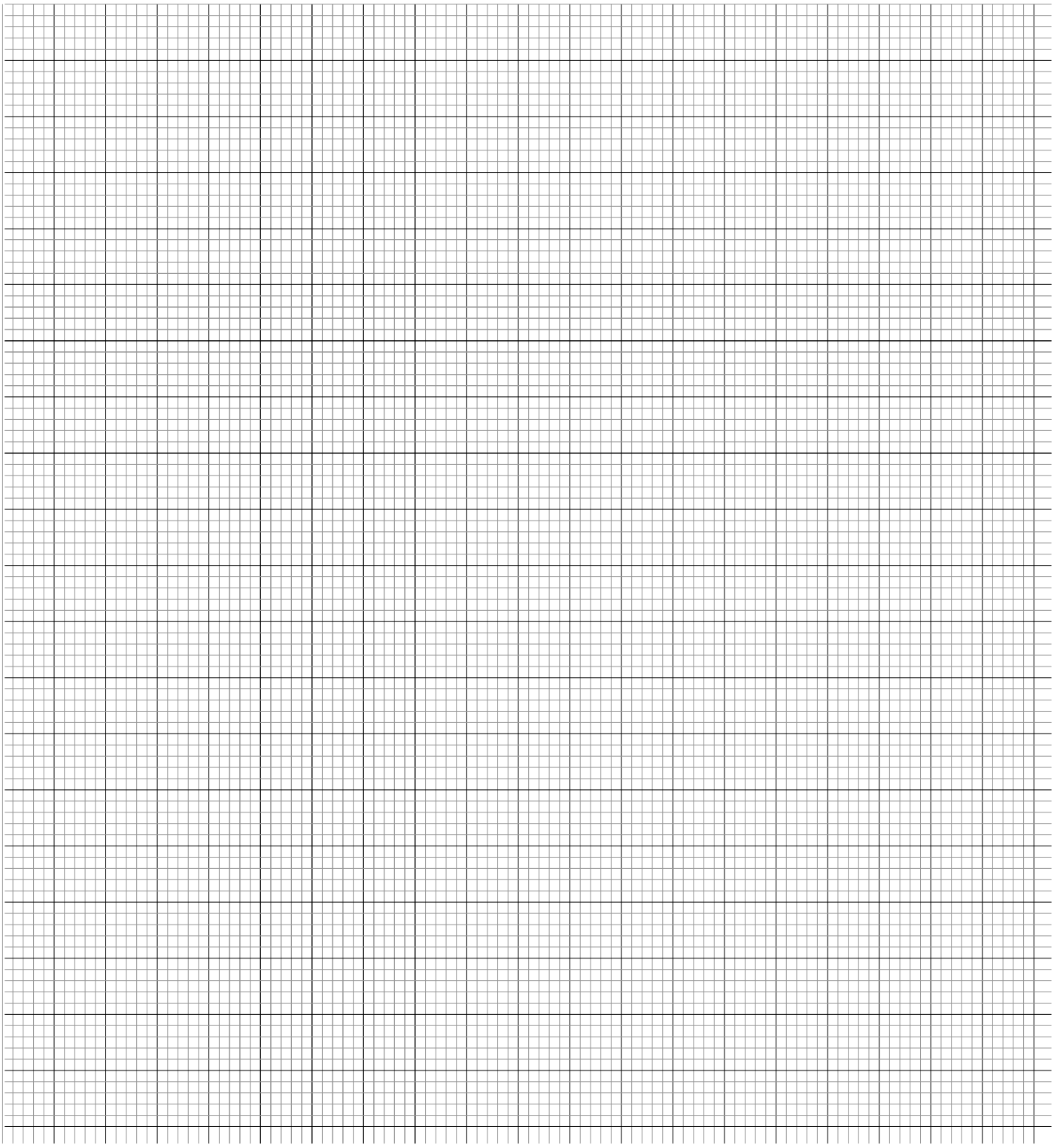
**TABLE 1**

| **Volume of water in the boiling tube ($cm^3$)** | **Crystallization temperature (ºC)** | **Solubility of solid P in g/100 g of water** |
|---|---|---|
| 4 | | |
| 6 | | |
| 8 | | |
| 10 | | |
| 12 | | |

**(4marks)**

**(a)** Complete **table 1** above by working out the solubility. **(1 mark)**

**(b)** On the graph provided, plot a graph of solubility of solid P against crystallization temperature. **(3marks)**



**(c)** From the graph, determine;

**(i)** The solubility of solid P at 50 ˚C **(1 mark)**

……

**(ii)** The temperature at which 65 g of solid P would dissolve in 100 g of water **(1 mark)**

……

## PROCEDURE II

**(i)** Transfer the contents of the boiling tube from **PROCEDURE I** into a clean 250 ml volumetric flask.

**(ii)** Add distilled water up to the mark

**(iii)** Label the resulting solution as solution P

**(iv)** Fill the burette with solution P

**(v)** Pipette 25cm$^3$ of solution L into a conical flask. Add three drops of phenolphthalein indicator

**(vi)** Titrate solution P against solution L to an accurate end point.Record your results in **table 2** below.

| **TABLE 2** | 1 | 2 | 3 |
|---|---|---|---|
| Final burette reading | | | |
| Initial burette reading | | | |
| Volume of solution P used (cm$^3$) | | | |

**(4 marks)**

**a)** Calculate Average volume of solution P used. **(1mark)**

……

……

**b)** **(i)** Moles of solution L used. **(1 mark)**

……

……

……

**(ii)** Moles of solution P used. **(1 mark)**

……

……

……

**(iii)** Moles of solution P in 250 $cm^3$ of solution P **(1 mark)**

……

……

……

**(iv)** The relative formula mass of P. **(1 mark)**

……

……

……

**(c)** Determine the value of n in the formula; $H_2C_2O_4.nH2O$ (H = 1, C = 12, O = 16) **(2marks)**

……

……

……

**2.** You are provided with solid E. Carry out the experiments below. Write your observations and inferences in the spaces provided.

Place all solid E into a boiling tube. Add about $20cm^3$ of distilled water and shake. Retain the contents of the boiling tube.

| **Observations** | **Inferences** |
|---|---|
| (1 mk) | (1 mk) |

Use $2cm^3$ of solution E, in a test tube in each experiment i, ii,iii,iv and v

**i.** To experiment i, Add two drops of aqueous Sulphuric vi acid

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**ii.** To experiment ii, add NaOH solution drop wise till in excess.

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**iii.** To experiment iii, dip a stirring rod into the solution, place the rod in a non-luminous flame..

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**iv.** To experiment iv, add two drops of lead (ii) nitrate solution.

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**v.** To experiment v, add a piece of aluminium foil followed by sodium hydroxide solution and warm . Test the gas given out with litmus papers.

| **Observations** | **Inferences** |
|---|---|
| **(2 mk)** | **(1 mk)** |

**3).** You are provided with liquid Q. carry out the tests below. Write your observations and inferences in the spaces provided.

**i).** To 2 $cm^3$ of liquid Q in a test tube, add universal indicator

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**ii).** Place 3 drops of liquid Q on a watch glass and ignite.

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

**iii).** To 2 $cm^3$ of liquid Q in a test tube , add two or three drops of acidified potassium dichromate VI and warm

| **Observations** | **Inferences** |
|---|---|
| ( 1 mk) | (1 mk) |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 6 PRACTICAL

## Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

**CONFIDENTIAL OF REQUIREMENTS**

- Burette
- Pipette
- 2 conical flasks
- 120$cm^3$ of 2.0M NaoH labelled B
- 100$cm^3$ 0f 0.2M $H_2SO_4$ labelledA
- 250$cm^3$ volumetric flask
- A label
- Pipette filter
- Stand and clamp
- 500$cm^3$ distilled water
- Phenolphthalein indicator
- 100$cm^3$ plastic beaker
- Thermometer
- 10$cm^3$ measuring cylinder
- 100$cm^3$ measuring cylinder
- 50$cm^3$ 2.0M HCl , Solution D
- 50$cm^3$ 2.0M NaoH
- 6 test tubes in a test tube rack
- 0.2g of solid N [$Al_2(SO_4)_3$]

**REAGENTS**

- 2M NaoH
- 2M $NH_4OH$
- Ba $(NO_3)_2$solution
- 2M nitric acid
- Potassium iodide solution

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 6 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

## INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

## FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**1.** You are provided with

- 2.0M NaoH solution labelled B
- Sulphuric(VI) acid solution labelled A `

You are to:

[a] Prepare a dilute solution of NaoH solution.

[b] Determine the concentration of in moles per litre.

**PROCEDURE 1**

i. Using a pipette 25.0cm$^3$ of solution B and place it into 250cm$^3$ volumetric flask.

ii. Add about 200cm$^3$ of distilled water and share well.

iii. Add more water to make up to 250cm$^3$mark. Label this solution C

**[a]** Calculate the concentration of the dilute solution C in moles per litres. **[2mks]**

……

……

……

**PROCEDURE 2**

**i.** Fill the burette with solution A and record the readings in the table below.

**ii.** Pipette 25cm$^3$ of dilute solution C and place it into 250ml conical flask.

**iii.** Add 2-3 drops of phenolphthalein indicator.

**iv.** Titrate with solution A.

**v.** Record your results in the table below.

**vi.** Repeat the titration two or more times and complete the table.

| | I | II | III |
|---|---|---|---|
| Final burette reading (cm$^3$) | | | |
| Initial burette reading(cm$^3$) | | | |
| Volume of solution A(cm$^3$) | | | |

**[4mks]**

**[a]** Determine average volume of the acid (solution A) used. **[1mk]**

……

……

……

**[b]** Determine moles of dilute solution C in the volume used. **[2mks]**

……

……

……

**[c]** Write an equation for the reaction taking pla **[1mk]**

……

……

**[d]** Determine the number of moles of A used. **[2mks]**

……

……

……

**[e]** Determine the concentration of A in moles per litre. **[2mks]**

……

……

……

**2.** You are provided with the following

- 2M sodium hydroxide solution, solution B
- 2M hydrochloric acid, solution D

You are required to determine the molar enthalpy of neutralization of the acid using sodium hydroxide.

## PROCEDURE

[i] Measure out $20cm^3$ of acid into a clean plastic beaker.

[ii] Record the temperature of this solution in the table below

[iii] Measure $5cm^3$ of sodium hydroxide and add it to the hydrochloric acid.

[iv] Stir with the thermometer and record the maximum temperature reached.

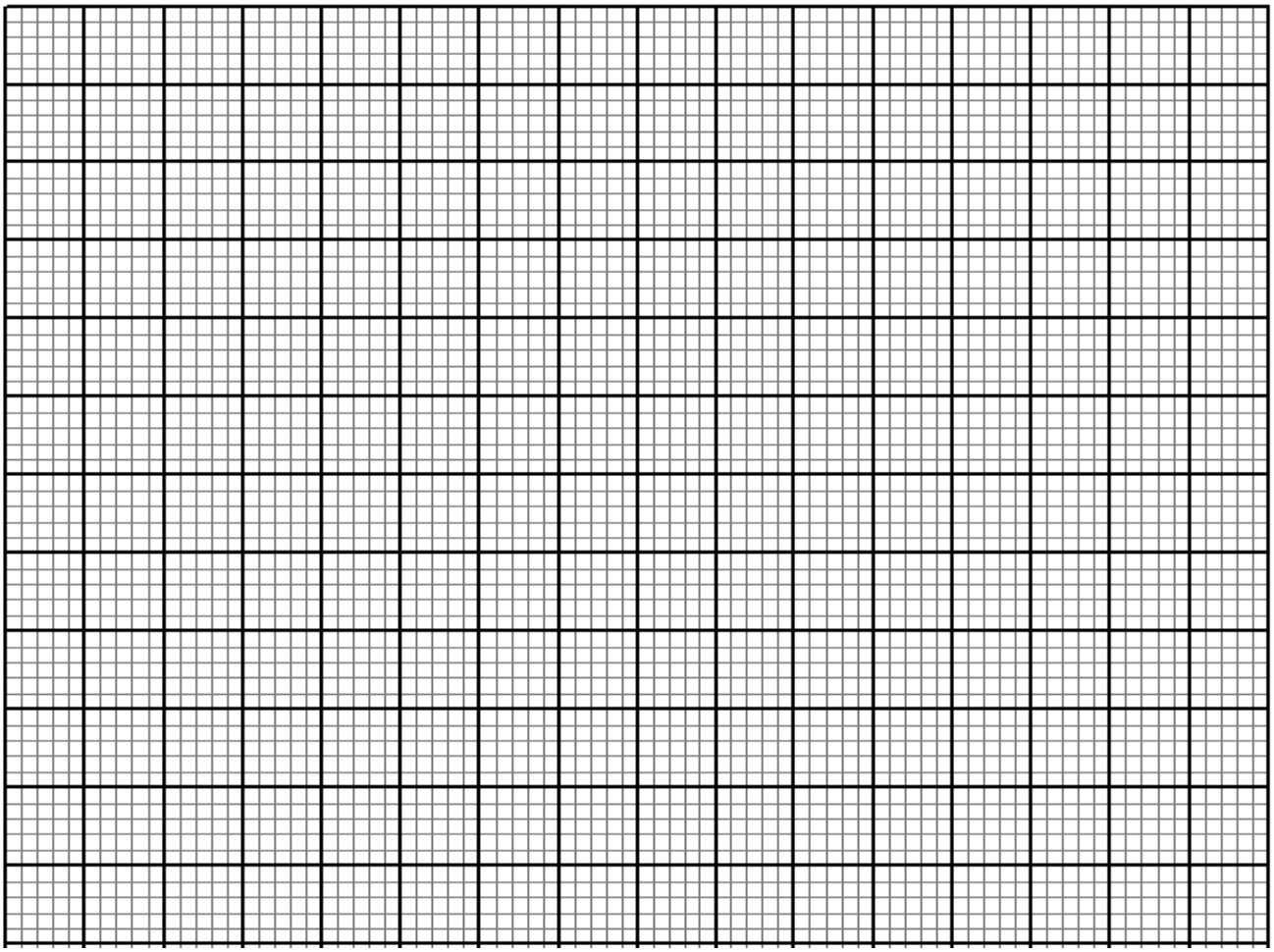
**[v]** Repeat the above procedure adding $5cm^3$ portions of sodium hydroxide until the total volume of the solution is $50cm^3$.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Volume of acid(cm3) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Volume of NaoH added $cm^3$ | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| Temperature($°C$)of solution | | | | | | | |

**[3mks]**

You are required to:

[a]. Plot a graph of temperature rise against sodium hydroxide added. **[3mks]**



[b]From your graph determine:

**[i]** maximum temperature change. **[1mk]**

……

……

……

**[ii]** the volume of NaOH that is required for complete neutralization **[1mk]**

……

……

……

**[iii]** Calculate the molar enthalpy of neutralization for this reaction. (C=4.2J/g/*K*) assume density of solution is $1gcm^{-3}$**)** **[2mks]**

……

……

……

**[iii]** The theoretical molar heat of neutralization is -57.2kj/mol-1.Compare your value in [ii] above with the theoretical value. Give the reasons for any differences noted between these two values. **[2mks]**

……

……

……

……

……

**3.** You are provided with solid N carry out the tests below and record your observations and inferences.

**[a]**Place a spatula of N in a test tube and add $5cm^3$ of water and shake well divide the solution in to three portions.

| **OBSERVATION (1mk)** | **INFERENCE (1mk)** |
|---|---|
| | |
| | |
| | |

**[b]** Add sodium hydroxide to the first portion drop wise while observing till in excess

| **OBSERVATION (1mk)** | **INFERENCE (2mks)** |
|---|---|

| | |
|---|---|
| | |

**[c]**Add ammonia solution to the second portion drop wise until in excess.

| **OBSERVATION (1mk)** | **INFERENCE (1mks)** |
|---|---|
| | |

**[d]** Add four drops of potassium iodide solution to the third portion.

| **OBSERVATION (1mk)** | **INFERENCE (1mks)** |
|---|---|
| | |

**[e]** Add three drops of acid barium nitrate to the fourth followed by 5 drops of nitric acid.

| **OBSERVATION (2mk)** | **INFERENCE (1mks)** |
|---|---|
| | |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 7 PRACTICAL

## Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**
**CHEMISTRY CONFIDENTIAL MECS TERM ONE 2021**

**1.** Each candidate should be provided with:

- $100cm^3$ of solution $M_2$
- $80cm^3$ of solution $M_1$
- Pipette
- Burette
- 2 conical flasks
- Filter funnel
- Pipette filler
- Methyl Orange Indicator
- Thermometer – 10 -$110^0$ C
- $200cm^3$ of distilled water
- 6 test tubes in a rack
- 2 boiling tubes
- Test tube holder
- About 1g of solid W in a stoppered container.
- About 1g of X in a stoppered container.
- 0.5g of $NaHCO_3$
- 5.0g of solid T
- 250ml glass beaker
- spatula
- 10ml measuring cylinder

## ACCESS TO

- Source of heat
- Methyl orange indicator, supplied with a dropper
- $Na_2SO_4$ supplied with a dropper
- 2M NaOH supplied with a dropper
- 2M $NH_4OH$ supplied with a dropper
- Acidified potassium Manganate (VI1)
- Lead Nitrate solution
- Acidified Barium Nitrate Solution
- Universal Indicator
- PH Colour Chart
- Bromine Water
-

**NOTE:**

- Solid X is Maleic Acid
- Solid W Aluminium sulphate
- Solution M1 is prepared by mixing 53g of $Na_2CO_3$ solid and 42g of NaCl and diluting it to one litre
- Solution M2 is 1.0M HCl.
- Solid T is 5g Oxalic Acid

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 7 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

### FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**1.** You are provided with the following solutions:

- $M_1$ containing 95g of a mixture of sodium carbonate and sodium chloride per litre of solution.
- $M_2$ which is 1MHCl.

You are to determine the percentage of sodium chloride in the mixture.

Proceed as follows. Fill the burette with $M_2$.

Pipette 25.0$cm^3$ of $M_1$ and titrate with $M_2$ from the burette using 3-4 drops of methyl orange indicator.

Stop titrating when a permanent pink colour appears. Repeat experiment and complete the table below.

**(a) Table 1**

| | I | II | III |
|---|---|---|---|
| Final burette reading ($cm^3$ ) | | | |
| Initial burette reading ($cm^3$ ) | | | |
| Volume of $M_2$ used ($cm^3$ ) | | | |

**(4 marks )**

**(b)** Determine the average volume of $M_2$ used. Show your workings. **(1 mark)**

**(c)** Determine the number of moles of $M_2$ used. **(1 mark)**

**(d)** Write down an ionic equation for the substances that react. **(1 mark)**

**(e)** Determine the number of moles of the carbonate used. **(1 mark)**

**(f)** Calculate the concentration of sodium carbonate **(1 mark)**

**(g)** Determine the mass of sodium carbonate in 1 litre of the solution **( Na = 23, C = 12,O = 16 )** **( 1 mark )**

**(h)** Determine the percentage of sodium chloride in the mixture. **(1 mark)**

**2.** You are provided with 5.0g of salt T. You are required to determine the solubility of salt T in water at different temperatures.

**Procedure**

(i) Place all salt T into a clean boiling tube.

(ii) Transfer $5cm^3$ of distilled water from 10ml measuring cylinder into the boiling tube containing salt T. Insert the thermometer into the boiling tube.

(iii) Heat the mixture of salt T and water carefully until all the salt dissolves and the solution is clear.

(iv) Remove the boiling tube from the flame and allow it to cool while stirring with the thermometer carefully and gently. NOTE: The temperature (Ts) at which the crystals first appear.

Record this temperature in the table.

(v) Using the same mixture from (iv) above, add from 10ml measuring $1cm^3$ of more water and repeat procedures (iii) and (iv) above. Carry out four (4) more experiments and enter you results in the table below.

**NOTE:**

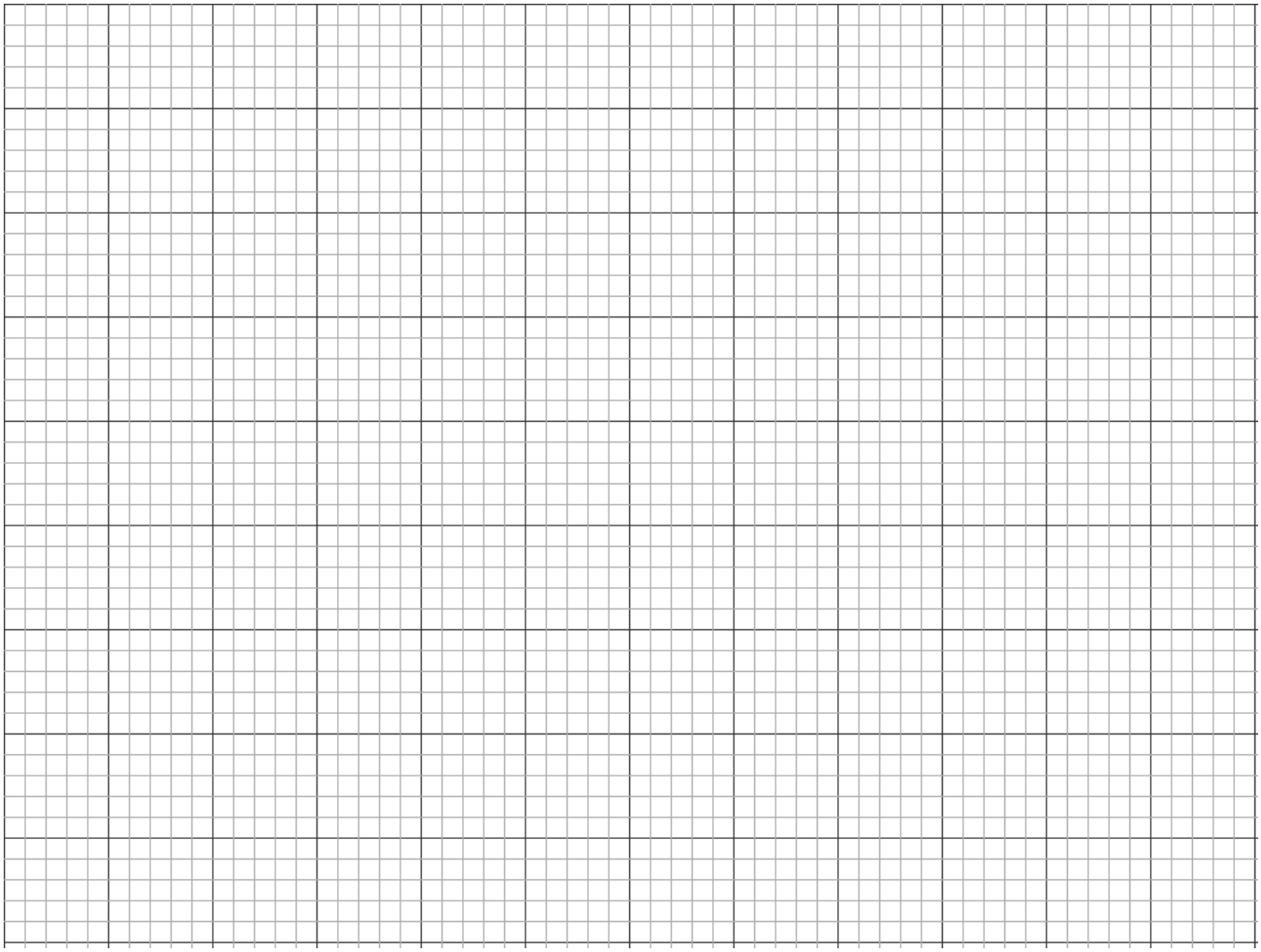
You may fasten cooling for the first two temperatures readings by pouring cold water from the tap on the sides of the boiling tube or insert the boiling tube in a beaker containing cold water

**TABLE II (6 marks)**

| Volume of water added ($cm^3$) | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|
| Crystallization temperature, Ts ($^0C$) | | | | | | |
| Solubility of salt T in g/100g water | | | | | | |

**(a)** Complete the table by calculating solubility at different temperatures

(b) Plot a graph of solubility of salt T against crystallization temperature Ts. **(3 marks )**



**(c)** Use your graph to determine the solubility of Salt T in water at $62^0C$**.** **(1 mark)**

**(d)** From your graph determine the temperature at which 75g of T will dissolve in 100g of water. **(1mark)**

**2.** You are provided with solid W. Carry out the test and record your observations in the spaces below. Put solid W in a boiling tube. Add about $10cm^3$ of distilled water and shake. Divide the solution into five portions

(i) To the first portion add sodium hydroxide drop wise then in excess

| **Observations** | **Inferences** |
|---|---|
| **(1 mark)** | **(1 mark)** |

**(ii)** To the second portion add 3 drops of sodium sulphate solution

| **Observations** | **Inferences** |
|---|---|
| **(1 mark)** | **(1 mark)** |

(iii)To the third portion add ammonium hydroxide drop wise then in excess

| **Observations** | **Inferences** |
|---|---|
| **(½mark)** | **(1 mark)** |

(iv) To the fourth portion, add 3 drops of lead nitrate solution and warm

| **Observations** | **Inferences** |
|---|---|
| **(1 mark)** | **(1 mark)** |

(v) To the fifth portion, add 3 drops of acidified barium nitrate

| Observations | Inferences |
|---|---|
| **(1 mark)** | **(1 mark)** |

**2.** You are provided with solid X. Carry out the test and record your observations in the spaces below.

**(i)** Put half of solid X on a metallic spatula and heat using a Bunsen burner

| Observations | Inferences |
|---|---|
| **(1 mark)** | **(1 mark)** |

**(ii)** Put the second half in a boiling tube. Add about $10cm^3$ of distilled water and shake. Divide the resulting solution into four portions

| Observations | Inferences |
|---|---|
| **(1 mark)** | **($\frac{1}{2}$ mark)** |

**(iii)** To the first portion add three drops of acidified potassium manganate (VII) and shake

| Observations | Inferences |
|---|---|
| **($\frac{1}{2}$ mark)** | **(1 mark)** |

**(iv)** To the second portion add three drops of bromine water and shake

| Observations | Inferences |
|---|---|
| **($\frac{1}{2}$ mark)** | **(1 mark)** |

**(v)** To the third portion add sodium hydrogen carbonate

| Observations | Inferences |
|---|---|
| **($\frac{1}{2}$ mark)** | **($\frac{1}{2}$ mark)** |

**(vi)** To the fourth portion add three drops of universal indicator. Compare the colour of the solution using pH colour chart

| Observations | Inferences |
|---|---|
| **($\frac{1}{2}$ mark)** | **($\frac{1}{2}$ mark)** |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 8 PRACTICAL

## Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

In addition to the apparatus and the fittings found in the chemistry laboratory, each candidate will require the following.

1. One Burette, 0-50ml.
2. One 25ml Pipette.
3. Two 250ml Conical Flask
4. One complete Retort Stand
5. One White Tile
6. One Pipette Filler
7. Six Test-tubes
8. Two Boiling tubes
9. Wash bottle filled with distilled water
10. One metallic spatula.
11. About 1g of solid sodium hydrogen carbonate.
12. Thermometer.
13. 120$cm^3$ solution A.
14. 120$cm^3$ solution B.
15. Distilled water in a wash bottle.
16. Solid R.
17. Solid Q.
18. Solid F.

**ACCESS TO**

1. Source of heat.
2. Acidified Potassium Manganite (VII)
3. Bromine water
4. Sodium sulphate solution
5. Aqueous sodium hydroxide solution.
6. Aqueous ammonia solution
7. Acidified barium nitrate solution

**NOTES**

- Solid **R** is 2.0g Potassium chlorate, $KClO_3$ crystals.
- Solution A is prepared by dissolving exactly 39.2g of $FeSO_4(NH_4)_2SO_4.nH_2O$ in $600cm^3$ of distilled water and dilute with distilled water to one litre.
- Solution B is prepared by dissolving 3.0g of $KMnO_4$ in 400ml of 2M $H_2SO_4$ and diluting with distilled water to one litre.

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 8 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

### INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

### FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**Q1.** You are provided with:

**i)** Magnesium ribbon, solid FA1.
**ii)** 0.7 M hydrochloric acid, solution FA2.
**iii)** 0.05 M sodium hydroxide solution, solution FA3.
**iv)** Distilled water.
**v)** Phenolphthalein indicator solution.

You are required to determine the:

i) Number of moles of hydrochloric acid that remain unreacted.
ii) Number of moles of magnesium that reacted.

**PROCEDURE I**

**a)** Using a burette, measure 50.0$cm^3$ of solution FA2 and place it in a 100ml plastic beaker.
**b)** Put the magnesium ribbon, solid FA1 in the 50.0$cm^3$ of solution FA2 in the 100ml beaker and allow the reaction to proceed until effervescence stops.

**PROCEDURE II**

**c)** Transfer ALL the solution obtained in Procedure I into a 250ml volumetric flask.
**d)** Top up the solution in the volumetric flask to calibration mark using distilled water. label this as solution FA4.
**e)** Empty the burette and fill it with solution FA3.
**f)** Pipette 25.0$cm^3$ of solution FA4 and place it into an empty 250ml conical flask. Add 3 drops of the phenolphthalein indicator solution and titrate against solution FA3 from the burette. Record the results in Table 1.
**g)** Repeat the titration of solution FA4 against FA3 two more times in order to complete Table 1.

Table 1.

| Titration | 1st | 2nd | 3rd |
|---|---|---|---|
| Final burette reading, $cm^3$ | | | |
| Initial burette reading, $cm^3$ | | | |
| Volume of solution FA3 used, $cm^3$ | | | |

**(4mks)**

Average volume of solution FA3 used = _____ $cm^3$ **(1mk)**

Calculate the number of moles of:

**i)** Sodium hydroxide in the average titre volume used. **(1mk)**

……

……

**ii)** Hydrochloric acid in 25.0 $cm^3$ of solution FA4**.** **(2mks)**

……

……

……

**iii)** Hydrochloric acid in 250.0 $cm^3$ of solution FA4. **(2mks)**

……

……

……

**iv)** Hydrochloric acid in 50.0 $cm^3$ of solution FA2. **(1mk)**

……

……

**v)** Hydrochloric acid that reacted with the magnesium. **(2mks)**

……

……

……

**vi)** Magnesium that reacted. **(2mks)**

……

……

……

**2**. You are provided with:

i). 2.20g of solid **BA11**,

ii). Thermometer.

iii). Distilled water.

iv). 100 ml Glass beaker

v). Boiling tube.

You are required to determine the solubility of compound **BA11** at various temperatures.

## Procedure I:

**a)** Place the whole amount of solid **BA11** supplied to you into a clean, dry boiling tube.

**b)** Using a burette, add 2.00$cm^3$ of distilled water into the boiling tube with solid **BA11**.

**c)** Insert a thermometer into the boiling tube and heat the mixture in the hot water-bath (use the 100ml beaker), while stirring continuously with the thermometer, until the temperature of the mixture is about $80^0$C when **ALL** the crystals **JUST** dissolve

**d)** Remove the boiling tube from the hot water bath and allow the contents to cool slowly while stirring with the thermometer. Note the temperature at which the crystals FIRST form/reappear and record this crystallization temperature, $T_c$ in Table 2

**e)** Using the same mixture from (d) above, add 1.00$cm^3$ of distilled water from the burette into the boiling tube containing the mixture and repeat steps (c) and (d) above. Continue in this way until a total volume of water added to the boiling tube is 7.00$cm^3$. Complete Table 2 by calculating the solubility of compound **BA11** in water at the different temperatures.

***Table 2:*** **(4mks)**

| Total volume of water added ($cm^3$) | Crystallization Temperature ,$T_C$($^o$C) | Solubility of compound **BA11** in water (g/100g of water) |
|---|---|---|
| 2.00 | | |
| 3.00 | | |
| 4.00 | | |
| 5.00 | | |
| 6.00 | | |
| 7.00 | | |

**f)** On the grid provided plot a graph of solubility of compound BA11 (vertical axis) against temperature. **(3mks)**

**g)** Using the graph determine:

I. the temperature at which 100.0g compound **BA11** would dissolve in 100g of water. **(1mk)**

……

……

II. solubility of compound **BA11** at $30.0^0$C. **(1mk)**

……

……

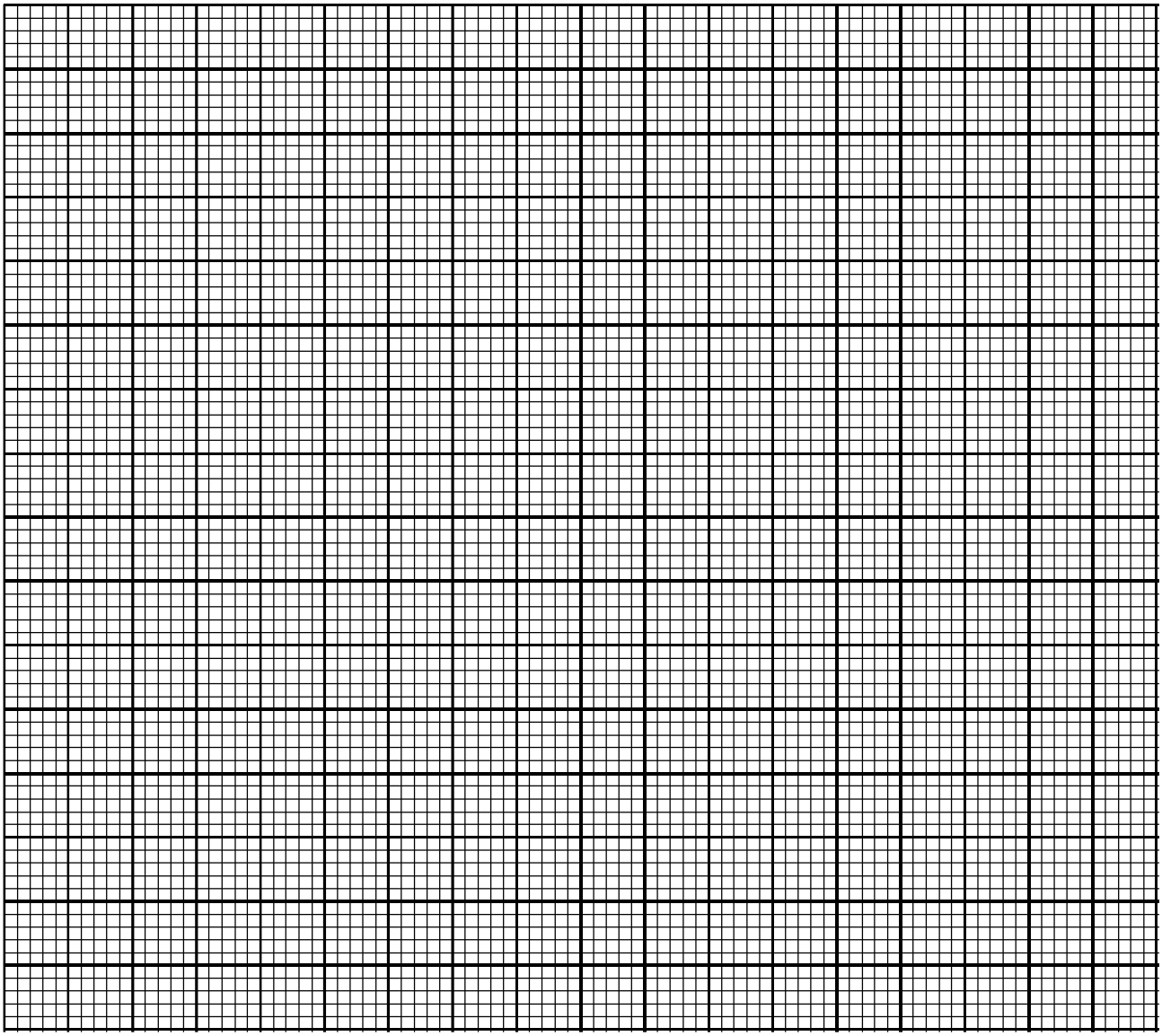
……

**h)** A solution containing 100g of **BA11** per 100g of water was cooled to $30.0^0$C. Determine the mass of crystals formed. **(2mks)**

……

……

……



**3.** You are provided with solids FA5, FA6 and FA7. Carry out the following tests and write your observations and interferences in the spaces provided.

a) Place all of solid FA5 in the boiling tube. Add about 10 $cm^3$ of distilled water and shake until all the solid dissolves. Label this as Solution FA5.

**i).** To about 2 $cm^3$ of Solution FA5 in a test tube, add 2M sodium hydroxide solution drop wise until in excess.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**ii).** To about 2 $cm^3$ of Solution FA5 in a test tube, add 2M ammonium hydroxide solution drop wise until in excess.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**iii)** To about 2 $cm^3$ of Solution FA5 in the test tube, add 4 drops of 2M sulphuric (VI) acid.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**iv)** To about 2 $cm^3$ of solution FA5 in a test tube, add 2 drops of potassium iodide solution.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**b).** Place solid FA7 into boiling tube. Add about 10$cm^3$ of distilled water and shake well. Label this as solution FA7 .Use this solution for the following tests.

i) Place about 2$cm^3$ of solution FA7 in a test tube and place the universal indicator paper provided into the solution hence determine its pH.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**ii).** To about 2$cm^3$ of solution FA7 made in (ii) above, add 3 drops of acidified potassium manganate (vii) solution.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

**iii).** To the remaining solution FA7 in the boiling tube, add the other half of solid FA6.

| OBSERVATION | INFERENCES |
|---|---|
| **(1mk)** | **(1mk)** |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 9 PRACTICAL

### Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

### INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**
**CONFIDENTIAL TO SCHOOLS**

Each candidate will require

1. Solution A 100$cm^3$
2. Solution B 150 $cm^3$
3. Solution C 100$cm^3$
4. Burette
5. 25ml pipette
6. 2 conical flasks
7. Retort stand
8. Filter funnel
9. Pipette filler
10. 100ml of distilled water
11. Thermometer
12. 1 Spatula – full of solid D
13. About 10ml liquid E
14. 4g solid F ( weighed exactly)
15. 2 boiling tubes
16. Six test tubes in a rack
17. Test tube holder
18. Metallic spatula

**ACCESS TO**

- 1M NaOH
- 1M $NH_4OH$
- 0.1M NaCl
  Acidified $K_2Cr_2O_7$
- $KMnO_4$- use some amount of solution B
- Source of heating
- **NOTES**

1. **Solid A**
   Dissolve 7.0g Ferrous Sulphate ($FeSO_4.7H_2O$) in 50ml of $1MH_2SO_4$, dilute to $1dm^3$ with water. (Should be prepared in the morning of the exam day)

2. **Solution B**
   Dissolve 0.8g of $KMnO_4$ in $50cm^3$ of $1MH_2SO_4$. Dilute to 1 $dm^3$ with water.

3. **Solution C**
   Measure $3cm^3$ of 20vol. $H_2O_2$
   Dissolve in $1dm^3$ of solution.

4. **1M $H_2SO_4$**
   Measure $55cm^3$ of conc. $H_2SO_4$ add to about $200cm^3$ of water, stir, dilute to 1 $dm^3$

5. **Solid D**
   Aluminium Nitrate

6. **Solid F**
   Potassium Chlorate ($KClO_3$)

7. **Acidified $K_2Cr_2O_7$**
   Dissolve 0.3g of $K_2Cr_2O_7$ in $50cm^3$ of $1MH_2SO_4$. Dilute to 1 $dm^3$ with water.

8. **Liquid E**
   Ethanol.

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 9 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

## INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

## FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**1**. You are provided with;

- Solution A containing 6.95g of Iron II Sulphate heptahydrate R.F.M = 278 in 250cm$^3$ of solution
- Solution B of potassium manganate (VII)
- Solution C of hydrogen peroxide.

**You are required to**

(a) Standardize the potassium manganate (VII) solution C

(b) Determine the concentration of hydrogen peroxide solution C.

**PROCEDURE I**

Pipette 25cm$^3$ of solution A into a conical flask.

Fill the burette with solution B. Titrate this solution against solution A until the first permanent pink colour appears. Record your results in table I and repeat the procedure to fill the table 1 below.

**Table 1**

| II | I | II | III |
|---|---|---|---|
| Final burette reading (cm$^3$) | | | |
| Initial burette reading (cm$^3$) | | | |
| Volume of solution B used (cm$^3$) | | | |

**(4 marks)**

**(i)** Calculate the average volume of solution B used **(1 marks)**

……

……

……

**(ii)** Given that the equation for the reaction is

$MnO^-_{4(aq)} + 5Fe^{2+}_{(aq)} + 8H^+_{(aq)} \longrightarrow Mn^{2+}_{(aq)} + 5Fe^{3+}_{(aq)} + 4H_2O_{(l)}$

**Calculate**

**a)** The number of moles of Iron II sulphate solution A used **(1mark)**

……

……

……

**b)** The number of moles of solution B that reacted. **(1mark)**

……

……

……

**c)** The concentration of the potassium manganate (VII) solution B in moles per litre. **(1mark)**

……

……

……

**PROCEDURE II**

Pipette 25cm$^3$ of hydrogen peroxide, solution C into a conical flask. Fill the burette with solution B. Titrate this solution against solution C until the first permanent pink colour appears. Record results in table II.

**TABLE II**

| Titre number | I | II | III |
|---|---|---|---|
| Final burette reading cm$^3$ | | | |
| Initial burette reading cm$^3$ | | | |
| Volume solution B used cm$^3$ | | | |

(4marks)

**(i)** Work out average volume of potassium manganate (VII) solution B used. **(1mark)**

……

……

……

**(ii)** Given that the equation for the reaction is

$$2MnO^-_{4\,(ag)} + 5H_2O_{(aq)} + 6H^+_{(aq)} \longrightarrow 2Mn^{2+}_{(aq)} + 8H_2O_{(l)\,(aq)} + 5O_{2(aq)}$$

Calculate

**a)** The number of moles of Potassium Manganate (VII) solution B that reacted. **(1mark)**

……

……

……

**b)** The number of moles of hydrogen peroxide solution C that reacted. **(1mark)**

……

……

……

**c)** The concentration of hydrogen peroxide solution C in moles per $dm^3$(mol $dm^{-3}$) **(1mk)**

……

……

……

**2.** You are provided with 4g of Solid F.
You are required to determine the solubility of solid F at different temperatures.
**PROCEDURE**

**a)** Carefully transfer all solid F in a clean boiling test tube and using a burette, add 15$cm^3$ of distilled water. Heat the mixture while stirring with a thermometer to about 85$^0$C. when all the solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which the crystals of solid F first appear. Record this temperature in Table III.

**b)** Transfer 5$cm^3$ of distilled water to the contents in the boiling tube. Warm the mixture while stirring with the thermometer until the solid dissolve. Allow the mixture to cool while stirring. Note and record the temperature at which crystals first appear.

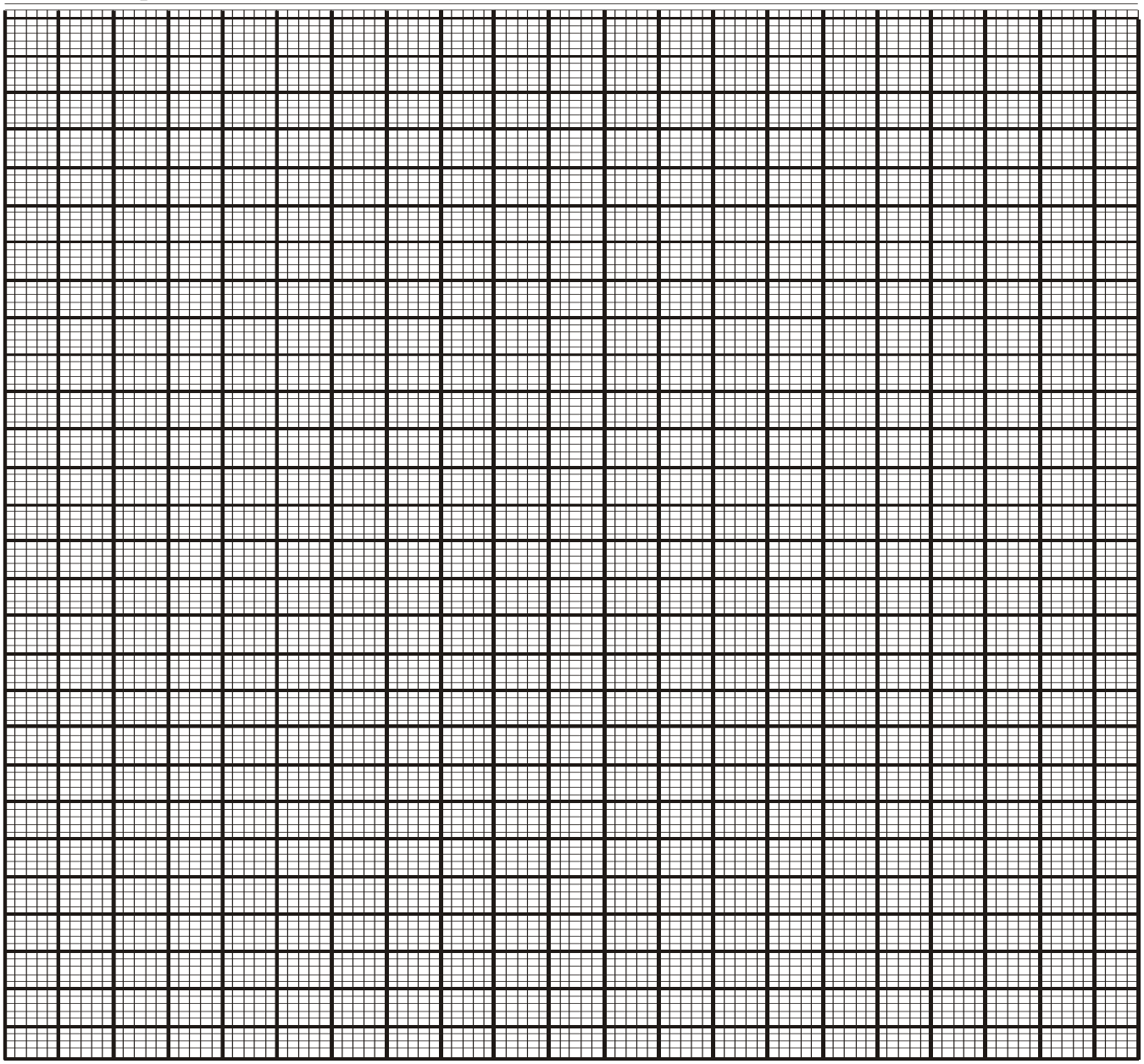
**c)** Repeat procedure (b) two or more times and record the temperatures in table III.

**d)** Complete table III by calculating the solubility of solid F at the different temperatures.
TABLE III

| Volume of water in the boiling tube ($cm^3$) | Temperature at which crystals of solid F first appear. | Solubility of solid F in g / 100g of water. |
|---|---|---|
| 15 | | |
| 20 | | |
| 25 | | |
| 35 | | |
| 40 | | |

**(6marks)**

**(i)** On the grid provided plot a graph of solubility of solid F (vertical axis) against temperature (horizontal axis). **(3marks)**



**(ii)** Using your graph, determine the temperature at which 15g of solid F, would dissolve in 100cm$^3$ of water. **(1mark)**

……

……

……

……

3. **You are provided with solid D. carry out the following tests and write down all the observations and inferences.**

**a)** Place half spatula end full of solid D in a dry test tube. Heat gently then strongly until there is no further change.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**b)** Place the remaining solid D in a test tube, add about 10cm$^3$ of distilled water and shake vigorously. Divide the mixture into four portions.

**i.** To the 1$^{st}$ portion, add 2M sodium hydroxide solution drop wise until in excess.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**ii.** To the 2$^{nd}$ portion, add ammonia solution drop wise till in excess.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**iii.** To the fourth portion add 4 drops of sodium chloride.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**II. You are provided with liquid E, Carry out the following tests on it.**

**a)** Place about one spatula end full of liquid E on a metallic spatula and ignite it in a Bunsen burner flame.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**b)** To $2cm^3$ of liquid E add 3 drops of acidified $KMnO_4$. Solution B.

| Observations | inferences |
|---|---|
| **(1mark)** | **(1mark)** |

**c)** To $2cm^3$ of liquid E add 3 drops of acidified $K_2Cr_2O_7$.

| Observations | References |
|---|---|
| **(1mark)** | **(1mark)** |

# KCSE FINAL PREDICTION

## CHEMISTRY PRACTICAL

## TRIAL 10 PRACTICAL

## Confidential

The information contained in this **KCSE Chemistry Prediction paper** is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for the **233/3 Chemistry** Practical examination.

**No one else** should have access to this information either directly or indirectly.

## INSTRUCTIONS

**In addition to the laboratory fittings each candidate requires the following:**

1. 2.0g of solid **A** weighed accurately and supplied in a stopped container.
2. About 150cm$^3$ of solution **S**.
3. 250ml beaker
4. 100ml measuring cylinder
5. Two dry boiling tubes
6. One 0.50ml burette
7. One 25.0ml pipette
8. One 10ml measuring cylinder
9. One thermometer – $10^0$C to $110^0$C
10. One filter funnel
12. One 250ml volumetric flask
13. Stopwatch/clock
14. Two 250ml conical flasks
15. Distilled water in a wash bottle (500ml)
16. 6 Dry test-tubes
17. One **metallic** spatula
18. 2 Boiling tubes
19. 1 Filter paper
20. 10ml measuring cylinder
21. Universal indicator paper
22. PH Chart

23. About 1g of solid E in a stoppered container.
24. About 1g of Solid F in a stoppered container.
25. About 0.5g of solid sodium hydrogen carbonate in a stoppered container.

**ACCESS TO:**

1. Methyl orange indicator supplied in a dropper bottle.
2. Sodium hydroxide solution supplied with a dropper
3. Ammonia solution supplied with a dropper
4. Acidified Potassium manganate(VII) solution supplied with a dropper
5. Nitric(V) acid solution supplied with a dropper
6. Sulphuric(VI) acid solution supplied with a dropper
7. Lead (II) nitrate solution supplied with a dropper
8. Source of heat like Bunsen Burner

**NOTES**

- Solution **S** is prepared by measuring exactly 5.0$cm^3$ of concentrated hydrochloric acid (specify gravity 1.18$g/cm^3$) and placing in one litre volumetric flask, and diluting with distilled water to the mark. Label this as solution **S. (0.05M HCL**).
- Solid E is 1g mixture of sodium sulphite and zinc carbonate in a ratio of 1:1.
- Solid F is Maleic acid or any other solid alkanoic acid in your lab.

2. Solids:

**A is Borax (Sodium Tetraborate decahydrate, $Na_2B_4O_7.10H_2o$)**

# KCSE FINAL PREDICTION

# CHEMISTRY

## TRIAL 10 PRACTICAL

**TIME: 2 ¼ HOURS**

**NAME…… INDEX NO……..…**

**SCHOOL…….. SIGN……**

**DATE……....**

## INSTRUCTIONS TO CANDIDATES

1. *Write your name, Index number in the space provided.*
2. *Answer all the questions in the spaces provided.*
3. *Mathematical tables and scientific calculators may be used.*
4. *All working must be clearly shown where necessary.*
5. *You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you read the question paper and make sure you have all the requirements.*
6. *Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.*

## FOR EXAMINERS USE ONLY

| SECTION | QUESTION | CANDIDATES SCORE |
|---|---|---|
| | 1 | |
| | 2 | |
| | 3 | |
| TOTAL SCORE | | |

**1.** You are provided with:

- 2.0g of substance A labeled solid **A**.
- Solution **S** 0.05M hydrochloric acid.
- Methyl orange indicator.

You are required to determine the:

- Solubility of substance **A** in water.
- Relative formula mass of substance **A.**

## Procedure 1

(i) Place 200cm$^3$ of tap water in a 250ml beaker and keep it for use in step (vi)

(ii) Place all of substance **A** in a dry boiling tube.

(iii) Using a burette, measure 10.0cm$^3$ of distilled water and add it to the substance **A** in the boiling tube.

(iv)While stirring the mixture in the boiling tube with a thermometer, warm the mixture using a Bunsen burner, until the temperatures rises to 65$^0$C. Stop warming the mixture.

(v) Allow it to cool while stirring with the thermometer.

(vi) When the temperature drops to 60$^0$C start the stop watch/clock, place the boiling tube in the beaker with tap water prepared in step (i) above.

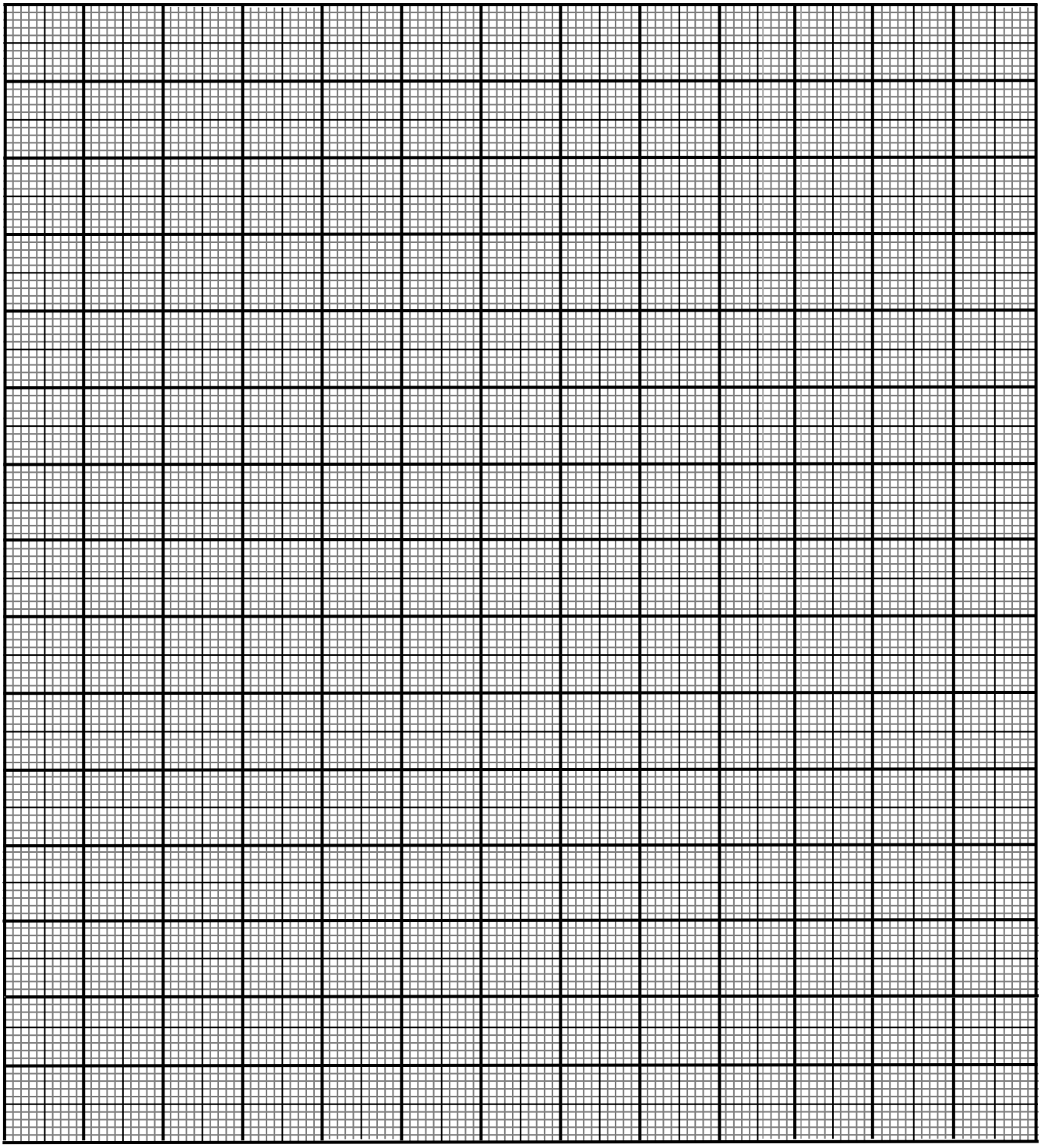
(vii) Continue stirring and record the temperature of the mixture after two minutes, then thereafter record the temperature of the mixture after every one minute interval and complete **table 1. Retain the mixture with the thermometer inside for use in procedure II below.**

**Table 1**

| **Time (minutes)** | 0 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Temperature** | | | | | | | | | | |

**(4 marks)**

On the grid provided, plot a graph of temperature (vertical axis) against time.**(3 marks)**



**(a)** Using the graph determine the temperature, ($T_s$) when 2.0g of substance **A** dissolves completely in 10.0$cm^3$ of distilled water. **(1 mark)**

(b) Calculate the solubility of substance **A** grams per 100g water at temperature, $T_s$.
**(1 mark)**

**Procedure II**

Using a funnel, transfer all the mixture obtained from procedure I into 250ml volumetric flask. Rinse the boiling tube and the thermometer with about 20cm$^3$ of distilled water and add the rinses into the volumetric flask. Repeat the rinsing two more times.

Add about 100cm$^3$ of distilled water to the volumetric flask. Shake until all the solid dissolves. Add more distilled water to the mark. Label this as solution **A**. Fill the burette with solution **A**. Using a pipette and **pipette filler**, place a 25.0cm$^3$ of solution **S** into a 250ml conical flask. Record your readings in **table 2** below. Repeat the titration two more times and complete the table.

**Table 2**

| | I | II | III |
|---|---|---|---|
| **Final burette reading** | | | |
| **Initial burette reading** | | | |
| **Volume of solution A used (cm$^3$)** | | | |

**(4 marks)**

(a) Calculate the:

(i) Average volume of solution **A** used. **(1 mark)**

(ii) Number of moles of hydrochloric acid, solution **S** used. **(1 mark)**

**(b)** Given that two moles of acid react with one mole of substance **A**. Calculate:

**(i)** Number of moles of substance **A** used. **(1 mark)**

**(ii)** Concentration of solution **A** in moles per litre. **(1 mark)**

**(iii)** Concentration of solution **A** in grams per litre. **(1 mark)**

**(iv)** Relative formula mass of substance **A**. **(1 mark)**

**2.** You are provided with solid **E**. Carry out the following tests and write your observations and inferences in the spaces provided.

**a)** Place all the sold E in a boiling tube. Add about $10cm^3$ of distilled water. Shake well and filter. Divide the filtrate into three portions and keep the residue for use in part (b).

**(i)**

| Observations | Inferences |
|---|---|
| (1 mark) | (1 mark) |

(ii) To the first portion add aqueous sodium hydroxide drop wise until in excess.

| Observations | Inferences |
|---|---|
| ( ½ mark) | (1 mark) |

(iii) To the second portion add three drops of lead (II)nitrate solution followed by 3cm$^3$ of dilute nitric(V) acid.

| Observation | Inference |
|---|---|
| (1 ½ marks) | (1 mark) |

(iv) To the third portion add three drops of acidified potassium manganate (VII) solution.

| Observation | Inference |
|---|---|
| (1 mark) | (1 mark) |

**(b)** Place the residue in (a) above in a boiling tube and add 10cm$^3$ of dilute nitric (V) acid. Retain the mixture for the tests below:

| Observation | Inference |
|---|---|
| ( ½ mark) | (½ mark) |

**(i)** To $2cm^3$ of the solution, add sodium hydroxide solution dropwise until in excess.

| Observation | Inference |
|---|---|
| ( 1 mark) | (1 mark) |

**(ii)** To $2cm^3$ of the solution, add three drops of sulphuric(VI) acid.

| Observation | Inference |
|---|---|
| ( ½ mark) | (½ mark) |

**(iii)** To $2cm^3$ of the solution, add ammonia solution dropwise until in excess.

| Observation | Inference |
|---|---|
| ( 1 mark) | ( ½ mark) |

**3.** You are provided with solid **F**. Carry out the following tests. Write your observations and inferences in the spaces provided.

a) Place about one third of solid **F** on a clean metallic spatula and burn it in Bunsen burner flame.

| Observation | Inference |
|---|---|
| (1 mark) | (1 mark) |

b) Place all the remaining solid F in a boiling tube. Add about $10cm^3$ of distilled water and shake until all the solid dissolves. Divide the resulting solution into three portions.

(i) To the 1st portion add two drops of acidified potassium manganate(VII).

| Observation | Inference |
|---|---|
| (1 mark) | (1 mark) |

(ii) To the second portion, add sodium hydrogen carbonate provided.

| Observation | Inference |
|---|---|
| (1 mark) | (1 mark) |

(iii) Determine the pH of the third portion. Describe the procedure followed.

**Procedure:** **(1 mark)**

| Observation | Inference |
|---|---|
| ( ½ mark) | ( ½ mark) |

# THE END

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