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School: $\qquad$
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Date: $\qquad$

233/3
CHEMISTRY

## PAPER 3

MAY/JUNE 2014
TIME: $21 / 4$ HOURS.

## CROSS COUNTRY EXAM 2014

Kenya Certificate of Secondary Education (K.C.S.E.)
Chemistry
Paper 3

## INSTRUCTIONS TO CANDIDATES:

- Answer all the questions on the spaces provided.
- All workings must be clearly shown where necessary
- Mathematical tables, and calculators may be used.


## For Examiner's Use Only:

| Question | Maximum score | Candidate's score |
| :--- | :---: | :--- |
| 1 | 24 |  |
| 2 | 16 |  |
| Total | $\mathbf{4 0}$ |  |

1. You are provided with the following;
(i) 2.1 g of solid sodium carbonate solid $\underset{\mathrm{V}}{ }$.
(ii) Hydrochloric acid solution $\mathbf{Y}$
(iii) 0.2 M sodium hydroxide, soletion $\mathbf{V}$

## This question has two parts:

## PART 1

Measure $60 \mathrm{~cm}^{3}$ of solution $\hat{\widehat{Y}}$ hydrochloric acid and transfer into a plastic beaker and measure its temperature $T_{1}, \ldots \ldots \ldots Q^{e^{s}} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . . .^{\circ} \mathrm{C}$
Take all the 2.1 g sodium carbonate and transfer into the solution in the beaker. Stir with the thermometer and record final temperature reached, $\mathrm{T}_{2}$ $\qquad$ .${ }^{0} \mathrm{C}$

Keep the mixture for part II and label it X.

## Calculations

(a) Determine the rise in temperature
$\Delta \mathrm{t}$.
(b) Determine the amount of heat evolved by the solution (density $=1 \mathrm{~g} / \mathrm{cm}^{3}$, specific heat capacity of solution $=4.2 \mathrm{kJKg}^{-1} \mathrm{~K}^{-1}$ )
(c) If the acid was in excess, determine the number of moles of sodium carbonate $(\mathrm{Na}=23, \mathrm{O}=16, \mathrm{H}=1)$
(d) Calculate the number of moles of hydrochloric acid which reacts
(e) Determine the molar heat of reaction of sodium carbonate

## PART II

To the mixture in part $\mathrm{I}(\mathrm{X})$ add $20 \mathrm{~cm}^{3}$ of distilleg water and mix well. Transfer the solution in the burette. Pipette $25 \mathrm{~cm}^{3}$ of NaOH , solution $\mathbf{V}$, into thesconical flask and titrate with solution $\mathbf{X}$ using phenolphthalein indicator. Repeat the titration two moredimes and complete the table below:

|  | S ${ }^{\text {S }}$ | II | III |
| :---: | :---: | :---: | :---: |
| Final burette reading $\left(\mathrm{cm}^{3}\right)$ |  |  |  |
| Initial burette readinge ${ }^{e}$ ( $\mathrm{cm}^{3}$ ) |  |  |  |
| Volume of $\mathbf{X}$ used $\left(\mathrm{cm}^{3}\right)$ |  |  |  |

(i) Determine the average volume of $\mathbf{X}$ used
(ii) Calculate the number of moles of NaOH in $25 \mathrm{~cm}^{3}$ of solution $\mathbf{V}$
(iii) Determine the number of moles of hydrochloric acid that reacted with moles of $25 \mathrm{~cm}^{3}$ of sodium hydroxide
(v) What is the total number of moles of hydrochlorie acid in the original $60 \mathrm{~cm}^{3}$ of HCL
(vi) Hence determine the concentration hydrochloric acid, solution $\mathbf{Y}$ in moles per litre
2. You are provided with solid $\mathbf{N}$. carry out the tests below, write your observations and inferences in the ${ }^{\text {es spaces provided. }}$

| $)^{88^{8}} \quad$ Test | Observation | Inferences |
| :---: | :---: | :---: |
| (ax) Take a spatula endful of $\mathbf{N}$ in a test-tube and add distilled water until half-filled. Shake well and divide the solution into 5 portions | (1mk) | (1mk) |
| (b) To the first portion add 2 M NaOH solution drop wise until in excess | (2mks) | (1mk) |
| (c)To the $2^{\text {nd }}$ portion add $2 \mathrm{M} \mathrm{NH}_{3(a q)}$ drop wise until in excess | (2mks) | (1mk) |
| (d) To the $3^{\text {rd }}$ portion add 3drops of 2 M HCl solution | (1mk) | (1mk) |
| (e) To the $4^{\text {th }}$ portion add about $1 \mathrm{~cm}^{3}$ of $2 \mathrm{M} \mathrm{Pb}\left(\mathrm{NO}_{3}\right)_{2}$ solution | (1mk) | (2mks) |
| (f) To the $5^{\text {th }}$ portion add about $1 \mathrm{~cm}^{3}$ of $2 \mathrm{M} \mathrm{Ba}\left(\mathrm{NO}_{3}\right)_{2}$ solution followed by dilute nitric acid. | (2mks) | (1mk) |

