**NAME…………………………………………………………………….ADM NO……………**

**SCHOOL……………………………………………………CANDIDATES SIGN ……………**

**DATE……………………… TEACHER..................................................................**

**233/3**

**CHEMISTRY PAPER 3**

**FORM IV**

**TIME: 21/4 HOURS**

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**CEKENAS END OF TERM 2 EXAM-2022**

**FORM FOUR**

***Kenya Certificate of Secondary Education. (K.C.S.E)***

**INSTRUCTIONS TO CANDIDATES**

1. *Write your name, admission number in the space provided.*
2. *Answer all the questions in the spaces provided*
3. *All working must be clearly shown where necessary.*
4. *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.*
5. *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**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MARKS** | **CANDIDATES SCORE** |
| 1 | 23 |  |
| 2 | 10 |  |
| 3 | 07 |  |
| **TOTAL** | **40 MARKS** |  |

1. You are provided with the following

 Sodium hydroxide solution A

 0.1M HCl labelled B

 An alkanoic acid labelled C

 You are required to

i) Standardize solution A

ii) Determine the mole ratio of reaction between sodium hydroxide and the alkanoic acid

iii) Calculate the molarity of solution C

iv) Determine the molar enthalpy of neutralisation of the alkanoic acid and sodium hydroxide

PROCEDURE 1

Using the pipette, place 25cm3 of solution A into a 250ml volumetric flask .Add distilled water as you shake up to the 250ml mark .Label the solution formed as D.

Fill the burette with solution B .Rinse the pipette and use it to transfer 25cm3 of solution D into a conical flask. Add 3 drops of phenolphthalein indicator and carry out titration .Repeat the procedure twice to obtain concordant values .Record the results below

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1 | 2 | 3 |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution B used (cm3)  |  |  |  |

(4mk)

a) Determine the average titre volume (1mk)

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

b) Calculate the number of moles of

i) HCl that reacted (1mk)

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

ii) NaOH in the 25cm3 of solution D ( 1/2mk)

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

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iii) Molarity of NaOH solution A (1mk)

 …………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

PROCEDURE 2

Rinse the burette and fill it with solution C .Run 16cm3 of solution C into a 100ml plastic beaker .Using a thermometer measure its temperature and record it in the table 2 below as initial .Add 4cm3 of solution A using a syringe .Stir with the thermometer immediately and note the highest temperature reached .Record it in the table as final temperature .Repeat the procedure with other volumes of A and C as shown in the

table and complete it . Rinse the beaker and the thermometer after each experiment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Volume of solution (cm3) | 16 | 12 | 8 | 6 | 4 | 2 |
| Volume of solution A (cm3) | 4 | 8 | 12 | 14 | 16 | 18 |
| Final temperature (°C ) |  |  |  |  |  |  |
| Initial temperature (°C) |  |  |  |  |  |  |
| Change in temperature |  |  |  |  |  |  |

d) On the grid below, plot the graph of change in temperature against volume of sodium hydroxide solution A (3mks)



e) From your graph determine,

i) The volume of sodium hydroxide solution A required to neutralize the alkanoic acid (1/2mk) ……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

ii) Highest change in temperature ΔT (1/2mk)

 ……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

f) Determine the volume of the alkanoic acid solution C, used in the neutralization (1/2mk)

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

g) Calculate the;

i) Concentration of the alkanoic acid solution C, given that the ratio of volume of alkali to the volume of acid is also the mole ratio (2mks)

 ……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

ii) Molar enthalpy of neutralisation of the acid by sodium hydroxide (2mks)

 (C=4.2J/g/k, density of solution =1g/cm3)

 ……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………….

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

a)Place all the solid P in a boiling tube .Add about 10cm3 of distilled water and shake the mixture thoroughly .Filter the mixture into another boiling tube .Retain the filtrate for use in the test 2 (b) below and dry the residue using a filter paper

i) Transfer about half of the residue in a dry test tube .Heat the residue strongly and test any gas produced using a burning splint

Observations Inferences

|  |  |
| --- | --- |
| 1mk | ­1mk |

ii) Place the rest of the residue in a dry test tube .Add 2cm3 of 2M hydrochloric acid .Retain the mixture for test (iii) below

|  |  |
| --- | --- |
| Observations | Inferences |
| 1mk | 1mk |

iii) To the solution formed in (ii) above, add aqueous ammonia drop wise till in excess

|  |  |
| --- | --- |
| Observations | Inferences |
|  |  |
| 1mk | 1mk |

b) i) To above 2cm3 of the filtrate obtained in a) above add aqueous ammonia drop wise until in excess

|  |  |
| --- | --- |
| Observations | Inferences |
| 1mk | 1mk |

ii) To about 2cm3 of the filtrate, add about 2cm3 of 2M hydrochloric acid

|  |  |
| --- | --- |
| Observations | Inferences |
|  |  |
|  1mk  | 1mk |

iii) To 2cm3 of filtrate add two drops of barium nitrate solution (2mks)

|  |  |
| --- | --- |
| Observations | Inferences |
|  1/2mk | 1/2mk |
|  |  |

3. You are provided with solid E carry out the following test and record your observations and inferences in the spaces provided

a) Place about one half of solid E in a dry test tube .Retain the other half for use in (b) below .Add all of the absolute ethanol provided to solid E in a test tube shake the mixture

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
| Observations | Inferences |
|  |  |
|  1/2mk | 1/2mk |

Divide the mixture formed into two portions

i) Determine the pH of the first portions

|  |  |
| --- | --- |
| Observations | Inferences |
|  |  |
|  1/2mk | 1/2mk |

ii) To the second portion, add about one half of sodium hydrogen carbonate provided

|  |  |
| --- | --- |
| Observations | Inferences |
|  |  |
|  1mk  |  1mk  |

b) Place the remaining solid E in a boiling tube 10cm3 of distilled water and shake. Boil the mixture and divide it into 3 portions while still warm

i) To the first portion add the remaining sodium hydrogen

|  |  |
| --- | --- |
| Observations | Inferences |
| 1/2mk | 1/2mk |
|  |  |

ii) The second portion add three drops of acidified K2Cr207  (1mks)

|  |  |
| --- | --- |
| Observations | Inferences |
| 1/2MK | 1/2mk |

iii) To the third portion add 5 drops of Bromine water (1mk)

|  |  |
| --- | --- |
| Observations | Inferences |
|  1/2MK | 1/2mk |