**HOLA SECONDARY SCHOOL**

**233/3**

**FORM 3 CHEMISTRY**

**PAPER 3**

**PRACTICAL**

**JUNE 2017**

**TIME: 1¼ HOUR**

**NAME** ……………………………………………….. **CLASS**……… **ADM/NO** …………..

 You are provided with:

* Dilute hydrochloric acid solution A
* 0.1M sodium hydroxide solution B
* 10g of a mixture of sodium hydrogen carbonate and sodium chloride per litre, solution C

 You are required to determine;

(i) Molarity of solution A

(ii) Percentage purity by mass of sodium hydrogen carbonate

**PROCEDURE 1**

 Fill the burette with solution A. Pipette 25cm3 of 0.1M sodium hydroxide solution B into a clean conical flask and add 2 drops of methyl orange indicator and titrate with solution A until a permanent pink colour occurs. Fill in the table below. Repeat the titration two more times and complete the table below.

 **TABLE I**

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

 (4 Marks)

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

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(b) Calculate the number of moles of hydrochloric acid solution A that reacted with 25cm3 of sodium hydroxide solution B. (3 Marks)

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(c) Calculate the concentration of solution A in moles per litre (2 Marks)

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**PROCEDURE II**

Pipette 25cm3 of solution C into a conical flask, Titrate with solution A using 3 drops of methyl orange indicator. Record your results in table II below.

**TABLE II**

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

 (4 Marks)

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

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 (b) Write an ionic equation for the reaction taking place between solution A and mixture C. (1 Mark)

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 (c) Calculate:

 (i) Molarity of sodium hydrogen carbonate in moles per litre (3 Marks)

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 (ii) Mass of sodium hydrogen carbonate in moles per litre (2 Marks)

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 (iii) Mass of sodium chloride in the mixture (2 Marks)

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**FORM 3 CHEMISTRY CONFIDENTIAL ATTN: SELINA**

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

* A burette
* A 25cm3 pipette
* A pipette filler
* A white tile
* 2 conical flasks
* Distilled water in a wash bottle
* A stand and a clamp
* 150cm3 of solution A
* 100cm3 of solution B
* 80cm3 of solution C

**ACCESS TO**

* Methyl orange indicator

**NOTES**

1. Solution A is prepared by adding 12.9cm3 of concentrated hydrochloric acid (specific gravity 1.18) to 600cm3 of distilled water then top up to one litre
2. Solution B is prepared by dissolving 4g of sodium hydroxide in 600cm3 of distilled water then top up to one litre.
3. Solution C is prepared by dissolving a mixture of 8.4g of sodium hydrogen carbonate and 1.6g of sodium chloride is about 600cm3 of distilled water and then top up to one litre.

**MARKING SCHEME**

1. Procedure 1

Table 1

|  |  |  |  |
| --- | --- | --- | --- |
| Table 1 | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A used (cm3) |  |  |  |

Complete table🗸(1mk)

Penalize to a maximum of 1/2mk for

* Inverted table
* Wrong arithmetic
* Burrette readings beyond 50cm3 except where explained
* Unrealistic titre values (below 1cm3) and above 50cm3

**Use of decimals 🗸(1mk)**

* Accept for 1mk;
* One decimal or 2 decimal places throughout otherwise penalize fully
* If 2 decimal places are used; the second digit after the decimal is either ‘0’ or 5 otherwise penalize fully.

**Accuracy**

Compare with the school/ teachers titre values if any

* Within $$ of T.V🗸1/2mk
* Within $$ of T.V🗸1/2mk
* Non-within $$ of each other T.V🗸(0mk)

**Averaging**

* If 3 averaged and within$$ of each other🗸(1mk)
* If 2 averaged and within$$ of each other 🗸(1mk)
* Averaging outside the range$$ (1mk)

**PROCEDURE I**

**TABLE I**

a) Average volume of solution A =$\frac{3 titre values within}{3}$🗸½ mk

 =correct answer 🗸½ mk

 or $\frac{2 titre values within}{2}$ 🗸½ mk

 Correct answer 🗸½ mk

b) Moles of solution A used

0.1M NaOH 0.1 moles in 1000cm3

 if 1000cm3=0.1moles🗸1/2mk

 25cm3= ?

 $\frac{25cm^{3}}{1000}x0.1moles=0.0025$ 🗸½ mk

NaOH(aq)+HCl(aq) Na Cl(aq)+H2O(l)

mole ratio base:Acid=1:1🗸½ mk

Mole of HCl solution A that reacted with NaOH=0.0025 🗸½ mk

c) Concentration of solution A in moles per litre.

 =Ans(a) contains 0.0025moles (Ans b) 🗸½ mk

 1000cm3 = ?

 =$\frac{1000cm^{3}}{Ans (a)}x0.0025 moles$

Correct answer. 🗸½ mk

**Procedure II**

|  |  |  |  |
| --- | --- | --- | --- |
| Table 2 | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A used (cm3) | 16.0 | 16.0 | 16.0 |

a) Average of volume of solution A

=$\frac{3 titre values within}{3}$ 🗸½ mk

correct ans🗸½ mk

b) H+(aq)+HCO3-(aq) H2O(l)+CO2(g)🗸(1mk)

c) i) Morality of sodium hydrogen carbonate in mols/l

 Moles of solution A used

 =$\frac{ans\left(c\right)procedure 1xans\left(a\right)procedure II}{1000}$ 🗸½ mk

Mole ratio acid: Hydrogen carbonate

1:1

Moles of sodium hydrogen carbonate solution C used

 =$\frac{Ans\left(c\right)procedure Ix Ans (a)procedure II}{1000} $ 🗸½ mk

Therefore

Molarity of NaHCO3 =$\frac{1000xans\left(c\right)procedure Ix ans \left(a\right)procedure II}{1000x25}$ 🗸½ mk

 =$\frac{Ans.\left(c\right)procedure I x Ans \left(a\right)procedure}{25}$

 = Correct answer 🗸½ mk

**Procedure II**

c) ii Mass of sodium hydrogen carbonate in moles/l

 RMM of NaHCO3=23+1+12+(16x3)

 =36+48

 =84

 .: , Mass of NaHCO3 in the mixture in grammes per litre

 = 84x ans (c) (i) √ ½ mk

 = correct answer 🗸½mk

iii) Mass of NaCl in the mixture

 = 10-ans (c ii) 🗸½mk

 = Correct Ans🗸½mk

iv) % purity of NaHCO3 = $\frac{ans \left(c ii\right)x100}{10}$🗸½mk