**Name………………………………………………………………Index No. …………**

**Candidate’s signature………………**

**Date………………………..**

233/3

**CHEMISTRY**

**(PRACTICAL)**

PAPER 3

**Time: 2 ¼ Hours**

**Kenya certificate of secondary education (K.C.S.E)**

**Time: 2 ¼ Hours**

## INSTRUCTION TO CANDIDATES

* Answer all the questions in the spaces provided in the question paper.
* You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed for this paper. This time is to enable you read the question paper and make sure you have all the chemicals and apparatus that you may need.
* **All** working **MUST** be clearly shown.
* Mathematical tables and calculators may be used.

**For Examiner’s Use Only**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum Score** | **Candidate’s Score** |
| **1** | **18** |  |
| **2** | **10** |  |
| **3** | **12** |  |
| **TOTAL SCORE** | **40** |  |

***This paper consists of 8 printed pages.***

***Candidates should check the question paper to ensure that all pages are printed as indicated***

***and no questions are missing***

**1.** You are provided with:

- Metal carbonate, MCO3, solid Q

- 2M hydrochloric acid, solution P

- Sodium hydroxide, solution R containing 40g per litre of solution.

You are required to determine the relative atomic mass of metal M.

**Procedure**

Measure accurately 100cm3 of solution P into a clean 250cm3 conical flask and add all the 4.69g of solid Q. MCO3. Shake well and wait for effervescence to stop. Label the resulting solution as S1. Pipette 25cm3 of solution R into a conical flask and add 2 – 3 drops of phenolphthalein indicator. Fill a burette with solution S1 and titrate against the solution R until the end point. Record your results in the table below. Repeat the procedure to fill the table.

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution S1, used cm3 |  |  |  |

Calculate **(4 marks)**

**(i)** average volume of solution S1 used **(1 mark)**

………………………………………………………………………………………………………………………………………………………………………………………………

**(ii)** Moles of sodium hydroxide, solution R used. **(2 marks)**

…………………………………………………………………………………………………………………………………………………………………………………………………………

**(iii)** Moles of hydrochloric acid, solution S1 in the average volume used. **(1 mark**)

…………………………………………………………………………………………………………………………………………………………………………………………………………

**(iv)** Moles of hydrochloric acid, solution S1 in 100cm3 of solution.` **(2 marks)**

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

**(v)** Moles of hydrochloric acid in the 100cm3 of the original solution P.  **(2 marks)**

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

**(vi)** Moles of hydrochloric acid, solution P, that reacted with solid Q, MCO3. **(2 marks)**

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

**(vii)** Moles of MCO3 that reacted **(2 marks)**

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

**(viii)** The relative formula mass of MCO3. **(2 marks)**

………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

**2.** You are provided with

- Magnesium ribbon labelled solid D

- 2.0 M hydrochloric acid labelled solution F.

- Stop watch

You are required to determine the rate of reaction between magnesium and hydrochloric acid at different concentrations.

**Procedure**

**(i)** Place five test tubes in a test tube rack and label them 1,2,3,4 and 5. Using 10cm3 measuring cylinder, measure out the volume of 2.0M hydrochloric acid, solution F, as shown in table II below. Pour into the corresponding test tubes.

**(ii).**Cut out five pieces each exactly 1cm length of magnesium ribbon solid D.

**(iii).**Transfer all the solution in test tube 1 into a clean 100cm3 beaker. Place one piece of magnesium into the beaker and start a stop watch immediately. Swirl the beaker continuously ensuring that the magnesium is always inside the solution. Record in the table the time taken for magnesium to disappear.

**(iv).**Repeat procedure (iii) for each of the solution in test tubes 2,3,4 and 5 and complete the table.

**Table II**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test tube number | 1 | 2 | 3 | 4 | 5 |
| Volume of solution F cm3 | 10 | 9 | 8 | 7 | 6 |
| Volume of water cm3 | 0 | 1 | 2 | 3 | 4 |
| Time taken (sec) |  |  |  |  |  |
| Rate of reaction 1/time |  |  |  |  |  |

**(5 marks)**

**(a)** Plot a graph of rate of reaction 1/time( y-axis) against volume of solution F.  **(3 marks)**

****

**(b)** Use the graph to determine the time that would be taken for a 1cm length of magnesium ribbon to disappear if the volume of the acid solution F used was 7.5cm3 **(1 mark)**

………………………………………………………………………………………………………………………………………………………………………………………………………………

**(c)** In terms of rate, explain the shape of your graph. **(1 mark)**

………………………………………………………………………………………………………………………………………………………………………………………………………………

**3.** You are provided with solid L which is a mixture. Carry out the tests below. Record your observations and inferences in the table, in order to determine the ions present in solid L.

Place the solid in about 10cm3 of distilled water and shake then filter the mixture. Keep both the filtrate and residue. Divide the filtrate into 3 portions.

**(i).**To the first portion add aqueous ammonia solution dropwise until in excess.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**ii)** To the second portion add lead (II) nitrate and warm

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**iii)** Transfer all the residue into a test tube and add dilute hydrochloric acid to it drop wise, shaking after each addition until a solution is formed. Divide the solution into 3 portions.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(iv).**To the first portion add sodium hydroxide dropwise until in excess.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(v).**To the second portion add ammonia solution dropwise until in excess.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(vi).**To the third portion add Barium nitrate solution.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(b).**You are provided with solid X. Carry out the tests below and record your observations and inferences in the table below.

**(a).**Place one spatula endful of solid x in a test tube and add about 10cm3 of distilled water. Shake well and use for test (i) below.

**(i).**Test 2cm3 of the solution in test tube with red litmus paper and blue litmus paper.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(ii).**To 2cm3 of the solution in a test tube, add one spatula endful of sodium hydrogen carbonate.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**(iii).**To 2cm3 of the solution, add three drops of acidified potassium manganate VII solution

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **½ mk** | **½ mk** |

**iv)** Place about 4cm3 of ethanol in a test tube and add two drops of concentratedsulphuric acid then add a spatula endful of solid X. Warm the mixture carefully. Shake well and pour the mixture into 20cm3 of water in a beaker.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| **1 mk** | **1 mk** |

**SET 9**

**MARKING SCHEME CHEMISTRY PAPER 233/3**

1. **Table 1**

Complete table – 2mks

Decimals point – 1mk

Accurate value – 1mk

**4mks**

1. Average ± 0.1 ( 20.0 + 20.0 + 20.0) = 20.0 cm3✓½ **1mk**

3 ✓½

1. 25.0 x 1 = 0.025

1000 ✓1 ✓1 **2mks**

1. NaoH(aq) : Hcl(aq) ✓1

1 1 ✓1

✓1

0.025 = 0.025 (same moles ) **2mks**

1. 20.0 cm3  = 0.025moles

100.0 cm3 = 0.025 x 100 ✓1

20

= 0.125 ✓1 **2mks**

1. 1000 cm3 = 2 mols

100 cm3 = 100/1000 x 2 ✓1

= 0.2 moles ✓1 **2mks**

1. 0.2 – 0.125 = 0.075 moles **2mks**

✓1 ✓1

1. MCO3(s) + 2HCl(aq) MCl2(aq) + H2O(l) + CO(aq) ✓1

Moles MCO3 = 0.075✓ ½

2

= 0.0375 moles ✓ ½ **2mks**

1. RFM of MCO3 = 4.69 ✓ ½

0.0375 = 125.06 ✓½

RAM of Q = 125.06 ✓½ – 60 = 65.06✓½ **2mks**

**Total 18mks**

2. **Table II**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test tube number** | 1 | 2 | 3 | 4 | 5 |
| **Volume of sol. F(cm3)** | 10 | 9 | 8 | 7 | 6 |
| **Volume of water (cm3)** | 0 | 1 | 2 | 3 | 4 |
| **Time taken (sec)** | 24.0 | 29.0 | 35.0 | 54.0 | 65.0 |
| **Rate of reaction 1/time(s-1)** | 0.0417 | 0.0345 | 0.0286 | 0.0185 | 0.0154 |

***Marking points for completing table II***

1. Complete table = 1mk
2. Decimal point in time = 1mk
3. Trend = 2mks
   * Increasing time
   * Penalize if decreasing time and award 0mk
   * Penalise if it is a mixed trend and award 0 mk
4. Accurate values of 1/time (rate) given in 4 decimal places 1mk
5. Graph of 1/time against volume

***Marking points***

* 1. Scale ( ¾ ) of graph paper) = ½ mk
  2. Labelling of axes with units = ½ mk
  3. Plotting of points correctly = 1mk
  4. Smooth curve = 1mk

1. 1/time for length 7.5cm = 0.02175 (Must be shown on graph)

If 1/time = 0.012175 ( ½ )

The time = 45.9777 Sec ( ½ )

***Award 0 mk if not shown on graph***

(c).As the concentration of F decrease ( by addition of more water) the rate of reaction

decreases ( ½ )

This is because in a more concentrated solution more molecules of F come into contact

with solid D ( ½ )

3. a)

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| i) No Precipitate formed ½ mk | Na+ , K+ , NH4+ present ½ mk |
| ii) White ppt insoluble on warming ½ mk | SO4-2, SO3-2 , or CO3-2May be present ( ½ mk) |
| iii) Effervescen occurs ( ½ mk) | CO3-2, SO3-2 May be present ( ½ mk) |
| iv) White ppt ½ mksoluble in excess | Zn2+, Pb2+ , Al3+ present ( ½ mk) |
| v) White ppt ½ mksoluble | Zn2+present ( ½ mk) |
| vi) White ppt ½ mk | CO3-2, SO4-2 present (1mk) |

b)

|  |  |
| --- | --- |
| i) Blue litmus paper turns red  Red litmus remains red ½ mk | Acidic cpd,H+ ions present ½ mk,R-COOH |
| ii) Effervescences or bubbles of gas ( ½ mk) | H+ present / acidic gas ½ mk,RCOOH |
| iii) Purple colour gets decolourised | C =C or -C ≡C- ½ mk |
| iv) Fruity smell ½ mk | R-COOH- Confirmed 1mk |

**CONFIDENTIAL INSTRUCTIONS**

**INSTRUCTIONS TO SCHOOLS**

1. Each candidate is expected to have the following:

(a) 4.69g (weighed accurately) of solid Q.

(b) 150cm3 of solution P

(c ) 100cm3 of solution R

(d) 50cm3 burette

(e) 25cm3 pipette

(f) phenolphthalein indicator

(g) Labels

(h) 100cm3 measuring cylinder

(i) About 1g of solid L

(j) 50cm3 of solution F

(k) 6cm length of solid D

(l) 100cm3 beaker

(m) 10ml measuring cylinder

(n) stop watch

(o) Test tube rack and 6 test-tubes

(p) About 1g of solid x

2. **Each candidate should have access to the following:**

(a) Source of heating

(b) 2M NaOH

(c ) 2M Ba(NO3)2

(d ) 0.5M Pb(NO3)2

(e) 2M NH3(aq)

(f) 1g of solid NaHCO3

( g) Red and blue litmus papers

( h) Acidified potassium manganate (VII) solution, KMnO4(H+)

(i) Ethanol

(j) Conc H2SO­4

(k) Distilled water

(l) Funnel

(m) 2 filter papers

**NOTE**

1. Solid L (mixture of Zinc carbonate and sodium sulphate in the ratio of 1:1
2. Solis X maleic acid
3. Solid Q is Zinc Carbonate
4. Solution P is 2M hydrochloric acid. It is prepared by dissolving 200cm3 of the concentrated acid in about 500cm3 of distilled water topping it upto 1 litre with distilled water.
5. Solution R is 1M sodium hydroxide. It is prepared by dissolving 40g of NaOH in about 500cm3 of distilled water and topping it upto 1 litre with distilled water
6. F is 2M hydrochloric acid, prepared as in (3) above.
7. Acidified KMnO4 is prepared by dissolving 3.16g of KMnO4 in 300cm3  distilled water and adding 400cm3 of 2M H2SO4 the topping it uptolitre with distilled water.