**Name:** ..................................................................................................**Class**........................

**Candidate’s signature**………………… **Date**……………

 **Index number**……………………………………………...

**233/3**

**CHEMISTRY**

**Paper 3**

**(PRACTICAL)**

**JUNE/JULY, 2013**

2 1/4 hours

**Kenya Certificate of Secondary Education**

**MOCK EXAMINATIONS, 2013**

**INSTRUCTIONS**

 ***You are not allowed to start working with apparatus for the first 15 minutes of the 2***1/4 ***hours allowed in this paper.*** *This is to enable you to read the question paper and to make sure you have all the chemicals and apparatus that you may need.*

***Answer ALL questions in the spaces provided.***

***Mathematical tables and electronic calculators may be used.***

***All working MUST be clearly shown where necessary***

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidate’s score** |
| **1** | **13** |  |
| **2** | **10** |  |
| **3** | **17** |  |
| **Total** | **40** |  |

**This paper consists of 9 printed pages.**

**Candidates should check the question paper to ascertain that**

**all the pages are printed as indicated and no questions are missing.**

1.You are provided with the following:

* 0.5M Sulphuric (VI) acid, solution A.
* 0.4M Sodium hydroxide, solution B.
* 0.24g metal X accurately weighed.

You are required to determine the relative atomic mass, RAM of metal X.

**Procedure**

i) Use a measuring cylinder to accurately measure 100cm3 of 0.5M sulphuric (VI) acid solution A and transfer it into an empty glass beaker.

ii) Add all the solid X into the solution A in the beaker. Stir the mixture gently with a glass rod until there is no more effervescence.

iii) Transfer all the resulting solution carefully into a 250ml volumetric flask. Rinse the beaker with distilled water and transfer the rinsing into the volumetric flask. Fill the flask to the mark with distilled water. Stopper the flask and shake the mixture to mix the solution well.Label the solution S.

iv) Pour some solution S to the empty beaker. Pipette 25.0cm3 of solution S and transfer it into a clean conical flask. Add 3 drops of phenolphthalein indicator to the solution.

v) Fill the burette to the zero mark with sodium hydroxide solution B. Titrate solution B against solution S in the conical flask till a permanent pink colour just appears.. Record your results in table I below.

vi) Repeat the titration two more times to complete the table.

Table I

|  |  |  |  |
| --- | --- | --- | --- |
|  |  I |  II |  III |
| Final burette reading in cm3 |  |  |  |
| Initial burette reading in cm3 |  |  |  |
| Volume of solution B used in cm3 |  |  |  |

 (3 marks)

a) Determine the average volume of the solution B used in the titrations. (1 mark)

b) Calculate the number of moles of sodium hydroxide in the average volume of **solution B**. (1 mark)

c) Write the chemical equation for the reaction between sodium hydroxide and the sulphuric (VI) acid in **solution S**. (1 mark)

d) Determine the number of moles of sulphuric (VI) acid in the 25.0cm3**solution S**.

(1 mark)

e) Hence calculate the number of moles of sulphuric (VI) acid in 250.0cm3 of **solution S**

(1 mark)

f) Calculate the number of moles of sulphuric (VI) acid in the original 100cm3 of 0.5M **solution A.**  (1 mark)

g) Determine the number of moles sulphuric (VI) acid that reacted with 0.24g of metal X. (1 mark)

h) If metal X is divalent, write the chemical equation for its reaction with the sulphuric (VI) acid. (1 mark)

i) Determine the number of moles of metal X that reacted with the sulphuric (VI) acid and hence the relative atomic mass (RAM) of metal X. (2 marks)

2) Magnesium carbonate reacts with dilute nitric acid as shown in the equation below.

MgCO3(s)  + 2HNO3(aq)  Mg(NO3)2(aq)  + H2O(l) + CO2(g)

You are provided with

* accurately weighed 2.0g of finely powdered magnesium carbonate.
* 60cm3 of 2M nitric acid.

You are required to determine the enthalpy for the reaction by carrying out the procedure below.

i) Use a measuring cylinder to measure accurately 50.0cm3 of 2M Nitric acid into the 100cm3 plastic beaker provided.

ii) Stir the acid gently and continuously with the thermometer. Measure the temperature of the acid after every half a minute for 2 minutes and record the values in table II.

iii) After exactly 2minutes, add all the magnesium carbonate to the acid. Stir with the mixture gently with the thermometer. Measure the temperature of the mixture after every half a minute to complete table II. (3 marks)

 **Table II**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time / min | 0 | ½ | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 |
| Temperature/ oC |  |  |  |  |  |  |  |  |  |  |  |

b) Plot a graph of temperature against time. (3 marks)

c) Use your graph to determine the maximum temperature change. (1 mark)

d) Calculate the heat energyH produced in joules in this reaction between Magnesium carbonate and dilute nitric acid. Use the formula

Energy change; H = Mass of solution × Specific heat capacity × Temperature rise

( Assume: Density of solution=1g/cm3, Specific heat capacity = 4.2J g-1K-1). (2 marks)

e) Calculate the enthalpy change H for the reaction of one mole magnesium carbonate with nitric acid. (Mg = 24, C = 12, O = 16) (1 mark)



3) You are provided with solid P which is a mixture of two salts containing two different cations and two different anions. Carry out the following tests and record your observations and inferences in the spaces provided.

a) Place some solid P in a dry test tube and heat it gently. Test any gas produced with cobalt (II) chloride paper.

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

b) Place about 2cm3 of 2M sodium hydroxide in a test tube. Add some solid P to the test tube. Warm the mixture gently and test any gas produced with a damp universal indicator paper. Record the pH value.

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

c) Place the remaining solid P in a boiling tube. Add about 8 cm3 of distilled water to the solid in the boiling tube. Shake well.

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

 Divide the resulting mixture into three portions.

i) To the first portion, add two drops of silver nitrate solution followed by some 2M nitric acid. Then add an excess solution of aqueous ammonia to the resulting mixture.

|  |  |
| --- | --- |
| Observations | Inference |
|  (2 marks) (2 marks) |  (1 mark) |

ii) To the second portion, add four drops of barium nitrate solution. **(Retain the resulting mixture for the next test)**

|  |  |
| --- | --- |
| Observation | Inference |
|  (1 mark) (1 mark) |  (2 marks) |

iii) To the test result of c (ii), add some dilute nitric acid until no further change. Test any gas evolved with a piece of filter paper soaked in acidified potassium dichromate (VI).

|  |  |
| --- | --- |
| Observations | Inference |
|  (2 marks) |  (1 mark) |

iv) To the third portion, add 3 drops of acidified potassium manganate (VII).

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