Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Index No.

Candidate’s Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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[**SERIES 5 EXAMS**](https://teacher.co.ke/notes/)

**233/3**

**CHEMISTRY**

**PAPER 3**

**PRACTICAL**

**2 ¼ HOURS**

**INSTRUCTIONS TO CANDIDATES**

1. Write your name and Index number in the space provide above.
2. Answer ALL the questions in the spaces provided.
3. This paper has 2 questions. You have 2 ¼ hours for the paper. The first ¼ hours will be used to check the apparatus.
4. Mathematical tables and silent calculators may be used.
5. All working MUST be clearly shown where necessary.

**FOR EXAMINER’SUSE ONLY**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| 1 | 22 |  |
| 2 | 18 |  |
| **TOTAL SCORE** | **40** |  |

1. You are provided with:

- Solid A, 2.0g of dibasic acid, H2X

- Solution B, 0.5M solution of the dibasic acid, H2X.

- Solution C, sodium hydroxide solution.

- Solution D, 0.02M acidified potassium manganate (VII) solution.

**You required to determine:**

1. The heat of reaction of solid A H2X with sodium hydroxide solution.
2. The number of moles of solution E that reacts with 2 moles of acidified potassium manganate (VII) solution.

**Procedure 1 (a)**

Place 40cm3 of distilled water into 100ml beaker. Measure the initial temperature of water and record in table **1 below**. Add all the solid A provided at once. Stir the mixture carefully with the thermometer until **all** the solid dissolves. Measure the final temperature and record in table 1.

**Table 1**

|  |  |
| --- | --- |
| Temperature (0C) |  |
| Initial temperature (0C) |  |

( 1½ marks)

(a) Determine the change in temperature, ΔT. (1 mark)

(b) Calculate the:

(i) heat change when H2X dissolves in water. (Assume the heat capacity of the solution

is 4.2 J/g/0C and density of the solution is 1g/cm3) (1mark)

(ii) the molar heat of solution, ΔH1 solution of the acid H2X.

(Molar mass of the acid H2X is 126g. (2marks )

**Procedure 1 (b):**

Place 40cm3 of solution B into 100ml beaker. Measure the initial temperature and record in **table II** below. Measure 40cm3 of sodium hydroxide, solution C. Add all the 40cm3 of solution C at once to solution. Stir the mixture carefully with the thermometer. Measure the final temperature reached and record in table II. (Keep remaining solution B for use in procedure II). Table II

|  |  |
| --- | --- |
| Temperature (0C) |  |
| Initial temperature (0C) |  |
|  |  |

(1 ½ marks )

(a) Determine the change in temperature, ΔT. (1mark)

(b) Calculate the:

(i) heat change for the reaction. (Assume the heat capacity of the solution is 4.2 J/g/0C

and density of the solution is 1gcm3 ) ( mark )

(ii) heat for the reaction of one mole of the acid H2X with sodium hydroxide, ΔH2. (2marks )

(c ) Given that the H2X (s) + 2OH- (aq)  2H2O (l) + X2- (aq)

Determine ΔH3 using an energy cycle diagram. (2marks )

**Procedure II**

Measure exactly 15cm3 of solution B and put in a 250ml volumetric flask. Add water as you shake up to the mark. Labelled as solution E. Using a pipette filler, pipette 25cm3 of solution E and place in a conical flask. Warm solution E to boiling. Fill the burette with solution D and titrate with hot solution E. Stop just when a permanent change in colour. Record your results in the **table III** below. Repeat the procedure to complete the table **III below**.

**TABLE III**

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

(4 marks )

(a) Calculate the average volume of solution D used. (1 mark )

(b) Calculate the number of moles of solution D reacting. (1 mark )

(c ) Calculate the number of moles of solution E used. (1 ½ marks)

(d) Calculate the number of moles of E which react with 2 moles of potassium manganate (VII) (2 marks)

2. (a) You are provided with a solution F in a conical flask.

Carry out the following tests and record your observations and inferences in the spaces

provided.

1. Add 20cm3 of 2M sodium hydroxide solution to solution F in the flask; shake well,

filter the mixture into a clean boiling tube. Retain the filtrate and the residue.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( ½ mark ) | (½ mark ) |

(ii) i) Place about 2cm3 of the filtrate in a test tube. Add 2M nitric acid drop wise until

in excess. Retain the mixture.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( ½ mark ) | (½ mark ) |

(iii) Divide the mixture in (ii), I above into two portions. To one portion add 2M sodium

hydroxide solution drop wise until in excess.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | (1 mark ) |

iv) To portion two, add 2M ammonia solution drop wise until in excess.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | (1 mark ) |

(v) Place about 2cm3 of the filtrate in a test tube. Add 3 drops of acidified barium chloride.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | (1 mark ) |

(vi) To the residue add about 5cm3 of 2M nitric (V) acid and allow it to filter into a test tube. Place

About 2cm3 of this filtrate in a test tube. Add 2M ammonia solution drop wise until in excess.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | 1. mark ) |

( c) You are provided with solid G. Carry out the test below and record your observations and inferences in the spaces provided.

(i) Using a metallic spatula heat half spatula endful of solid G in a non-luminous flame. Remove it when it ignites.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | (1 mark ) |

(ii) Put the remaining solid G in a boiling tube. Add about 5cm3 of distilled water and shake

vigorously. (Keep the content for the next test)

|  |  |
| --- | --- |
| Observation | Inferences |
| ( ½ mark ) | ( ½ mark ) |

1. Divide the resulting solution into two portions. To the first portion add two drops of acidified potassium manganate (VII) solution and shake vigorously.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( ½ mark ) | (½ mark ) |

(iv) Test pH of the second portion using pH indicator paper.

|  |  |
| --- | --- |
| Observation | Inferences |
| ( 1 mark ) | (1 mark ) |