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

**School ………………………………………………... Candidate’s Signature ……………………… Date ………………...........................………..**

**233/3**

**CHEMISTRY**

**PAPER 3**

**(PRACTICAL)**

**INSTRUCTIONS:**

* + - * Write your name and index number in the spaces provided above.
* Answer **ALL** questions in the spaces provided.
* You are **NOT** allowed to start working with the apparatus for the first 15minutes of the 2 hours allowed for this paper. This time will enable you read through the question paper and make sure you have all the chemicals and apparatus required.
* Mathematical tables and electronic calculators may be used.
* All working **must be** clearly shown where necessary.

**For Examiner’s use only**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidate’s score** |
| 1 | 22 |  |
| 2 | 10 |  |
| 3 | 8 |  |
| **TOTAL SCORE** | 40 |  |

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

***Candidates should check to ensure that all pages are printed as indicated and no questions are missing.***

1. You are provided with:-

* 2.2g of solid A, A dibasic acid with the formula H2X.
* Solution B, 0.5M aqueous H2X.
* Sodium hydroxide, solution C.
* Solution E, Acidified Potassium Manganate (VII).

You are required to determine;

1. i) The molar heat of solution of solid A.

ii) The heat of reaction of one mole of H2Xsolution B with Sodium hydroxide solution C.

1. The heat of reaction of solid A, H2X with Sodium hydroxide solution C.
2. How the rate of reaction of the dibasic acid, H2X and acidified Potassium Manganate (vii) solution A varies with temperature.

**Procedure I**

**Step I**

Place 35cm3 of distilled water into a 100ml plastic beaker. Measure the initial temperature of the water and record in table 1 below. Add all of solid A at once. Stir the mixture carefully with the thermometer until all the solid dissolves. Measure the final temperature reached. Record it in table 1. (Retain the solution in this step for use in procedure II).

Table I

|  |  |
| --- | --- |
| Final temp OC |  |
| Initial temp OC |  |

(2marks)

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

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b) Calculate the;

1. Heat change when the solid H2X dissolves in water. (Assume the heat capacity of solution is 4.2jg-10C-1 and density = g/cm3) (1mark)

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1. Number of moles of the acid that were used given that the relative formula mass of H2X is 126. (1mark)

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1. Molar heat of solution of acid H2X, ∆H1 (1mark)

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**Step 2**

Place 35cm3 of aqueous acid, solution B into a 100cm3 clean plastic beaker. Measure the initial temperature and record it in table II below. Measure 35cm3 of sodium hydroxide solution C. Add all of the 35cm3 of solution C at once to solution B in the beaker. Stir the mixture with the thermometer. Measure the final temperature reached and record in table II.

Table II

|  |  |
| --- | --- |
| Final temp OC |  |
| Initial temp OC |  |

(2marks)

c) Determine the change in temperature ∆T2. (1mark)

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d) Determine the;

1. Heat change of reaction (Assume the heat capacity of solution is 4.2jg-10C-1and density is 1g/cm3). (1mark)

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1. Number of moles of the acid H2X, used. (1mark)

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1. Molar heat of reaction, ∆H2 of the aqueous acid H2X, with sodium hydroxide. (1mark)

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e) Calculate the molar heat of reaction, ∆H3 of the solid dibasic acid H2X, with aqueous sodium hydroxide solution C. (2marks)

H2X(S) + 2OH-(aq) 2H2O (l) + X2-(aq)

H2X(s) H2X (aq)

Na2X (aq) + H2O (l)

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**Procedure II**

Transfer the solution obtained in step I of procedure I into a clean 250ml volumetric flask. Add distilled water to make upto the mark label this as solution D. Place solution E in the burette. Run 10.0cm3 portions of solution E from the burette into four clean test tubes. Place 10.0cm3 of solution D into a clean boiling tube using a clean 10ml measuring cylinder. Place the boiling tube in a water bath provided and allow its content attain a temperature of 450C. Remove the boiling tube from the water bath and add the first portion of solution E and at the same time start a stopwatch. Record the time taken for the purple colour of the solution to decolorise in table III. Repeat the procedure using the same volumes of solution D and E at temperatures of 550C,650C and 750C to complete table III.

* + 1. Table III

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Temperature of solution DOC | 45 | 55 | 65 | 75 |
| Time taken for decolorisation (seconds) |  |  |  |  |
| Reciprocal of time, 1/t (sec-1) |  |  |  |  |

(3 marks)

* + 1. On the grid provided plot a graph of reciprocal of time 1/t (sec-1) on the y-axis against the temperature of solution D. (3marks)

![](data:application/x-msmetafile;base64,)

* + 1. i) From the graph, determine the time taken for decolourisation of the mixture if the temperature of solution D is 60OC. (1mark)

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ii) How does the rate of reaction of Potassium Manganate(VII) with the dibasic acid H2X solution vary with the temperature? (1mark)

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1. You are provided with solid H. Carry out the tests below. Record your observation and inferences in the spaces provided.

Put all solid H in a boiling tube. Add about 15cm3 of distilled water and shake thoroughly.

* 1. To about 2cm3 of solution H, add sodium hydroxide drop wise until in excess.

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

* 1. To about 2cm3 of solution H, add 5cm3 of Sodium Sulphate solution.

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

* 1. Dip clean end of glass rod into solution H and place it on the non-luminous flame.

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

* 1. To about 2cm3 of solution H, add 1cm3 of hydrochloric acid followed by 3 drops of Barium Chloride solution.

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

* 1. To about 2cm3 of solution H, add 3 drops of acidified Potassium dichromate (VI) solution.

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

1. You are provided with solid M. Carry out the tests below. Write your observations and inferences in the spaces provided.
   * 1. Put a half of solid M provided in a clean dry test tube, heat gently then strongly.

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

* + 1. Put the remaining solid into a boiling tube and add about 10cm3 of distilled water, shake thoroughly

1. To about 2cm3 of the solution M, add 3drops of bromine water.

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

1. To about 2cm3 of solution M, add 3 drops of acidified potassium dichromate (VI), then warmgently.

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

1. To about 2cm3 of solution M, add two drops of the universal indicator.

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