**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**INDEX NO. \_\_\_\_\_\_\_\_\_\_\_\_\_\_     DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**233/3**

**CHEMISTRY**

**PAPER 3**

**OPENER EXAMINATION TERM 3, 2022**

**SEP/OCT 2022**

**PRACTICAL**

**TIME; 2 ¼ HOURS**

**FOR EXAMINER’S USE ONLY**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MAXIMUM SCORE** | **Student’s score** |
| **1** | **23** |  |
| **2** | **09** |  |
| **3** | **08** |  |
| **Total score** | **40** |  |

**QUESTION 1**

You are provided with

* Aqueous sulphuric (VI) acid ,solution **X**
* 4.0g  of sodium carbonate to make 500 cm3 of solution , solution **Y**
* An aqueous solution of substance **M**, solution **M**

You are required to determine the;

* Concentration of solution **X**
* Enthalpy of reaction between sulphuric (VI)acid and substance **M**

**Procedure I**

Using a 50ml measuring cylinder, measure 25.0cm3of the solution X and transfer into 250 ml volumetric flask. Add water to the mark to make 250cm3 of solution. Label this as solution L. Fill a burette with solution L . Pipette 25.0cm3 of solution Y into a conical flask. Add 3 drops of methyl orange indicator provided and titrate with solution L until a permanent yellow colour just appears. Record your result in table I below. Repeat the titration two more times and complete the table I below.

Table 1

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

(4mk)

    Calculate the ;

(i) Average volume of solution **L** used                                                                    (1mk)

ii) Concentration of sodium carbonate, solution **Y** in moles per litre (Na=23,C=12,O=16)

                                  (1mrk)

iii) the number of moles of sodium carbonate that reacted. (1mk)

iv) Concentration of sulphuric (VI) acid in solution **L** in moles per litre. (2mks)

(v) Concentration of Sulphuric (VI) acid in solution **X** in moles per litre. (1mk)

**PROCEDURE B**

Label six test tubes as 1, 2,3,4,5, and 6. Using a measuring cylinder, measure 2cm3 of solution **X** into test –tube number 1, 4cm3 in test –tube number 2. Continue with this process for all the other test tubes as shown in **table II** below.

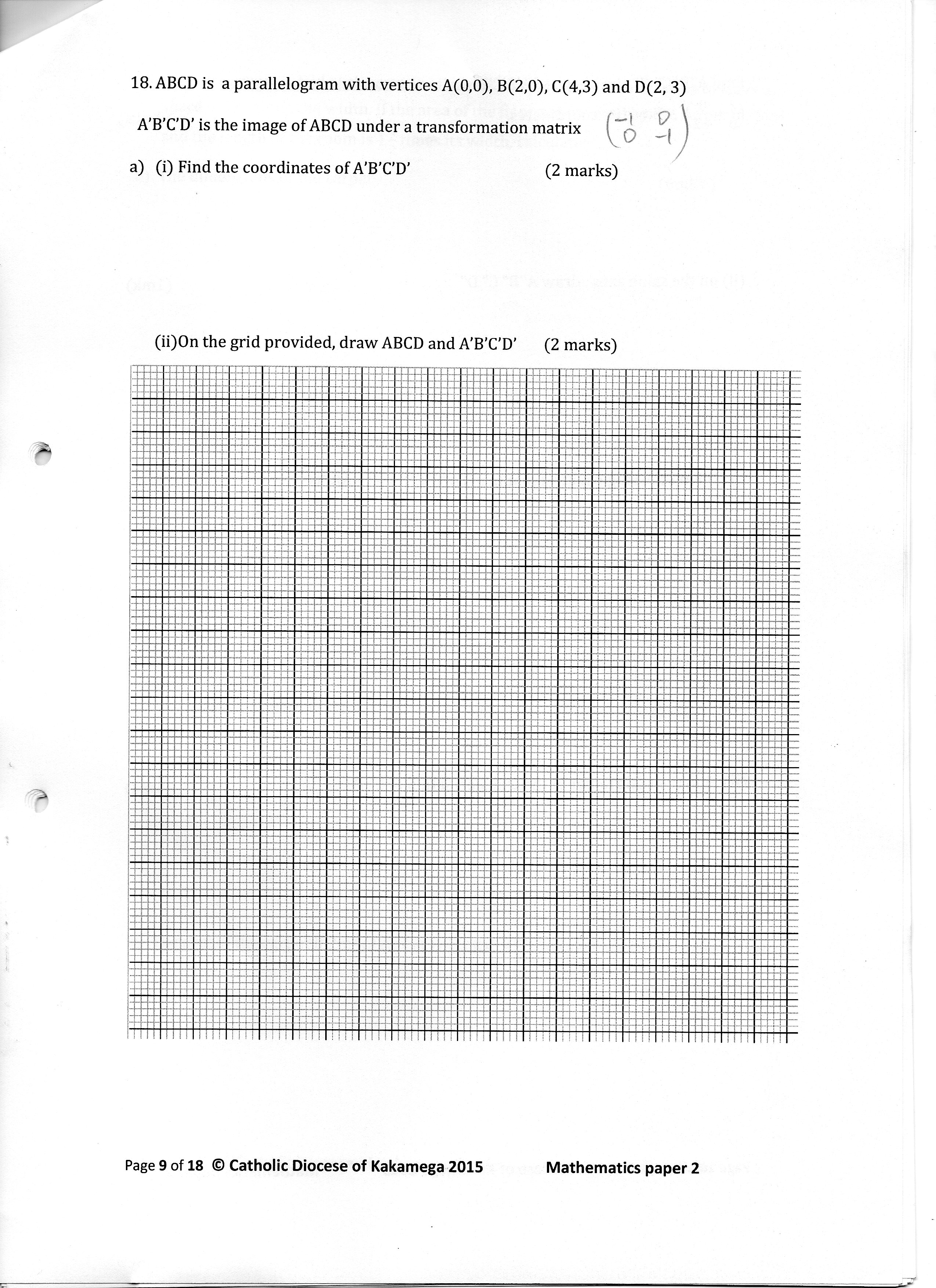
Clean the burette and fill it with solution **M**. From the burette, Place 14cm3of solution **M** into a boiling tube .Measure the initial temperature of this solution and record it in the **table II** below to the nearest 0.50C. Add the content of test tube number 1 to the boiling tube containing solution **M** . Stir the mixture with thermometer and record the highest temperature reached in table II below .Repeat the process with the other sample of solution **M** given in the table II and complete the table.

**Table II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test tube number | 1 | 2 | 3 | 4 | 5 | 6 |
| Volume of solution **X**(cm3) | 2 | 4 | 6 | 8 | 10 | 12 |
| Volume of solution **M** (cm3) | 14 | 12 | 10 | 8 | 6 | 4 |
| Highest temperature of mixture (oC) |  |  |  |  |  |  |
| Initial temperature of solution M (oC) |  |  |  |  |  |  |
| Change in temperature ,ΔT (oC) |  |  |  |  |  |  |

                                                                                                                                                            (5 mks)

(i) On the grid below, draw a graph of ΔT (vertical axis ) against volume of solution **X.** (3mks)

****

(i) From the graph, determine;

  (a) the maximum change in temperature   (1mk)

           (b)The volume of X required to give the maximum change in temperature        (1mk)

(ii)Calculate the

    (a)Number of moles of sulphuric (VI) required to give the maximum temperature change. (1mk)

   (b)Molar enthalpy of reaction between sulphuric (VI) acid and substance M in kilojoules per mole of sulphuric (VI) acid. (Specific heart capacity =4.2J/g/K, density of solution =1.0g/cm3)             (2mks)

2 You are provided with solid **T**. Carry out the tests below and write your observation and inferences in the spaces provided.

a) Place the solid in a boiling tube and add about 10cm3 of distilled water and shake well.

    Divide the mixture into 4 portions

1. To the 1st portion, add 5 drops of sodium hydroxide solution

|  |  |
| --- | --- |
| Observations (1mk) | Inferences (1mk) |
|  |  |

        (ii) Dip a glass rod in the solution and burn it over a non-luminous flame.

|  |  |
| --- | --- |
| Observations (1/2 mk) | Inferences (1/2 mk) |
|  |  |

1. To the 2nd  portion, add 5 drops of barium nitrate provided .(Retain for use in (iv)

|  |  |
| --- | --- |
| Observations (1mk) | Inferences(1mk) |
|  |  |

        (iv) To the mixture in (iii) above, add about 2cm3 of dilute nitric (V) acid provided.

|  |  |
| --- | --- |
| Observations (1mk) | Inferences (1mk) |
|  |  |

(iv)To the 3rd  portion, add 5 drops of acidified potassium dichromate (VI)

|  |  |
| --- | --- |
| Observations (1mk) | Inferences (1mk) |
|  |  |

3. You are provided with solid G .Carry out the tests below and record your observations and inference In the spaces provided.

1. Using a metallic spatula, burn 1/3 of the solid G on a non-luminous Flame.

|  |  |
| --- | --- |
| Observations (1mk) | Inference (1mk) |
|  |  |

b) Place the remaining solid in a boiling tube. Add about 10cm3 of distilled water and shake until the solid dissolves .Divide the mixture obtained into 4 portions ,

(i)To the 1st portion, add solid sodium hydrogen carbonate provided.

|  |  |
| --- | --- |
| Observation (1/2 mk) | Inference (1/2 mk) |
|  |  |

(ii)Test the pH of the 2nd portion.

|  |  |
| --- | --- |
| Observatio (1/2 mk) | Inference (1/2 mk) |
|  |  |

(iii)To the 3rd portion, add 3 drops of acidified potassium manganate (VII)

|  |  |
| --- | --- |
| Observation (1mk) | Inference(1mk) |
|  |  |

iv)To the 4th portion ,add 4 drops of acidified  potassium dichromate (VI)

|  |  |
| --- | --- |
| Observation (1mk) | Inference(1mk) |
|  |  |