NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ INDEX NO. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SCHOOL \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SIGNATURE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**233/3**

**CHEMISTRY**

**PAPER 3**

**(PRACTICAL)**

**TIME: 2 HOURS**

JULY, 2017

233/3

CHEMISTRY

PAPER 3

(PRACTICAL)

TIME: 2 HOURS

**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.
* This paper consists of **8** printed pages
* Candidates should check to ensure that all pages are printed as indicated and no questions are missing

**For Examiner’s use only**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| **1** | **21** |  |
| **2** | **12** |  |
| **3** | **07** |  |
| **TOTAL SCORE** | **40** |  |

**1. You are provided with;**

* Aqueous hydrochloric acid labeled solution A.
* Solution B containing 8.0 g per litre of sodium carbonate.
* An aqueous solution of substance C labeled solution C.

**You are required to determine the;**

* Concentration of solution A.
* Enthalpy of reaction between hydrochloric acid and substance C.

**Procedure I**

Using a pipette and pipette filler, place 25.0cm3 of solution A into a 250ml, volumetric flask.

Add distilled water to make 250cm3 of solution. Label this solution D.

Place solution D in a burette. Clean the pipette and use it to place 25.0cm3 of solution B into a conical flask. Add 2 drops of methyl orange indicator provided and titrate with solution D. Record your results in table 1. Repeat the titration two more times and complete the table.

**Table 1**

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

(4 marks)

Calculate;

i) Average volume of solution D used. (1 mark)

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ii) Concentration of sodium carbonate in solution B.

(Na = 23.0, O = 16.0, C = 12.0) (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iii) Concentration of hydrochloric acid in solution D. (2 marks)

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iv) Concentration of hydrochloric acid in solution A. (1 mark)

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**Procedure II**

Using a clean burette, place 2 cm3 of solution A into a boiling tube. Take the initial temperature of the solution in the boiling tube and record it in table 2. Using a clean measuring cylinder, measure 14 cm3 of solution C into 100cm3 beaker and add it to a solution A in the boiling tube. Stir the mixture immediately with a thermometer and record in table 2 the highest temperature reached. Repeat the experiment with the other sets of volumes of A and C in the table and complete it.

(Rinse the thermometer and the boiling tube with distilled water after each experiment)

**Table 2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Volume of solution A (cm3) | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
| Volume of solution C (cm3) | 14 | 12 | 10 | 8 | 6 | 4 | 2 |
| Initial temperature of solution C (°C) |  |  |  |  |  |  |  |
| Highest temperature of solution C (°C) |  |  |  |  |  |  |  |
| Change in temperature ΔT (°C) |  |  |  |  |  |  |  |

(5 marks)

i) On the grid provided, draw a graph of ΔT (vertical axis) against volume of solution A used . (3 marks)



ii) From the graph, determine;

I The maximum change in temperature. (½ mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

II. The volume of solution A required to completely neutralize solution C. (½ mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

iii) Calculate the;

I. Number of moles of hydrochloric acid required to completely neutralize solution C. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

II. Molar enthalpy of reaction between hydrochloric acid and substance C (in kilojoules per mole of hydrochloric acid). Assume the specific heat capacity of the solution is 4.2 Jg−1K−1 and density of solution is 1.0 gcm−3. (2 marks)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.** You are provided with solid Q. Carry out the following tests on Q and record your observations and inferences in the spaces provided.

a) Place a spatula of solid Q into a boiling tube and add 12 cm3 of distilled water.

Shake the mixture thoroughly. Divide the mixture into five portions.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

b) To the first portion, add 5 cm3 of 2M Nitric (V) acid.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

c) To the second portion, add four drops of lead (II) nitrate solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

d) To the third portion, add four drops of Barium nitrate solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

e) To the fourth portion, add sodium hydroxide solution dropwise until in excess.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

f) To the fifth portion, add ammonia solution dropwise until in excess.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

**3.** You are provided with substance Y.

Carry out the following tests on Y and record your observations and inferences in the spaces provided.

a) Describe the appearance of solid Y. (1 mark)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b) Scoop a little solid Y with a clean metallic spatula and ignite it using non-luminous part of the Bunsen burner flame.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

c) Add about 10 cm3 of distilled water to the remaining solid Y in a boiling tube.

Divide the resulting mixture into 2 portions.

i) To the portion one, add 3 drops of acidified potassium manganate (VII) solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

ii) To portion two, add sodium hydrogen carbonate.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |