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

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

**233/3**

**CHEMISTRY**

**PAPER 3**

**(PRACTICAL)**

July/August 2015

**TIME: 2 HOURS**

233/3

CHEMISTRY

PAPER 3

(PRACTICAL)

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

* Write your name, school and index number in the spaces provided above.
* Sign and write the date of examination in the space 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 | 19 |  |
| 2 | 8 |  |
| 3 | 13 |  |
| 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:

* Solution P, 0.625M hydrochloric acid.
* Solution Q, sodium hydroxide solution.
* Solution R, containing 49g/l of dibasic acid H2A.

You are required to:

* Dilute solution Q with distilled water.
* Standardise the diluted solution Q with P.
* Determine the relative formula mass of A.

**Procedure I**

Using pipette filler, place 25cm3 of solution Q into a 250cm3 volumetric flask. Add distilled water as you shake and make to the mark. Label this as solution S. Fill the burette with solution P. Pipette 25.0cm3 of solution S into a clean conical flask. Add 2-3 drops of phenolphthalein indicator and then titrate with solution P from the burette. Record your results in table 1 below. Repeat the procedure to obtain two other consistent results.

**Table I**

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

(4 marks)

a) Calculate:

i) Average volume of P used (1 mark)

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ii) Moles of P used to react with 25.0cm3 of the diluted solution S. (1 mark)

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iii) Moles of solution S in 25cm3 of the diluted solution S. (1 mark)

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iv) The moles of sodium hydroxide in 1000cm3 of solution S. (1 mark)

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b) Using your results in (a)(ii), determine the concentration in moles per litre of the original sodium hydroxide, solution Q. (1 mark)

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**Procedure II**

Empty your burette completely of solution P and rinse it with some distilled water. Fill the burette now with solution R. Pipette 25.0cm3 of solution S into a clean conical flask. Add 2-3 drops of phenolphthalein indicator and titrate it with solution R from the burette. Record your results in Table 2 and repeat the procedure to complete the table.

**Table II**

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

(4 marks)

c) Determine:

i) Average volume of R used. (1 mark)

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

ii) The number of moles of sodium hydroxide in 25cm3 of solution S. (1 mark)

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1. Moles of R that reacted with 25cm3 of solution S. (1 mark)

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

d) Calculate the concentration of solution R in moles per litre. (1 mark)

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e) Find the relative formula mass of X (H = 1) (2 marks)

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

**2.** You are provided with:

* 0.2M sodium thiosulphate solution M.
* 2M hydrochloric acid solution N.
* Stopwatch

You are required to determine the rate of reaction of sodium thiosulphate and hydrochloric acid.

**Procedure**

1. Measure 15cm3 of solution M into a clean conical flask using a measuring cylinder.
2. Add 30cm3 of distilled water to the solution M in the beaker.
3. Place the beaker over a cross (X) on the white tile. Add 5cm3 of solution N and immediately start the stopwatch.

Shake the mixture well.

1. Record the time taken for the mark X to be obscured.
2. Repeat the experiment with different volumes of solution M and distilled water and complete the table III below.

**Table III**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Volume of solution M (cm3) | 15 | 20 | 25 | 30 | 35 |
| Volume of water (cm3) | 30 | 25 | 20 | 15 | 10 |
| Volume of solution N (cm3) | 5 | 5 | 5 | 5 | 5 |
| Time taken for X to be obscured |  |  |  |  |  |

(3 marks)

1. Plot a graph of time in seconds against volume of solution M. (3 marks)



1. From the graph determine the time taken when 22cm3 of solution M are used with 23cm3 of distilled water. (1 mark)

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

1. Explain the shape of the graph obtained. (1 mark)

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

**3.** (I) You are provided with a solid labelled D. Carry out the following tests, record the observations and

make the correct inferences.

1. Place solid D in a boiling tube and add about 40cm3 of distilled water while shaking. Filter the mixture and divide the filtrate into four portions, keep the residue for part (b).
2. To the first portion, add sodium hydroxide dropwise until in excess.

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

1. To the second portion, add a few drops of dilute sulphuric (VI) acid.

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

1. To the third portion, add a few drops of barium nitrate solution followed by a few drops of dilute hydrochloric acid.

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

b) Place the residue in (a) above in a boiling tube. Add dilute nitric (V) acid while shaking till the

solid just dissolve. Divide the solution into two portions.

|  |  |
| --- | --- |
| Observations | Inferences |
| (½ mark) | (½ mark) |

1. To the first portion, add a few drops of sodium hydroxide dropwise till in excess.

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

1. To the second portion, add ammonia solution dropwise until in excess.

|  |  |
| --- | --- |
| Observations | Inferences |
| (½ mark) | (½ mark) |

(II) You are provided with liquid F. Carry out the following tests. Write your observations and

inferences in the spaces provided.

1. Place about 1cm3 of solution F on a watch glass. Place a burning splint to the liquid on the watch glass.

|  |  |
| --- | --- |
| Observations | Inferences |
| (½ mark) | (½ mark) |

1. Place about 2cm3 of liquid F in a test tube, add two drops of potassium dichromate.

|  |  |
| --- | --- |
| Observations | Inferences |
| (½ mark) | (½ mark) |

1. Place the remaining amount of liquid F, add a spatula of sodium carbonate provided.

|  |  |
| --- | --- |
| Observations | Inferences |
| (½ mark) | (½ mark) |