CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

18 JANUARY 2018 (p.m.)

J1801212032

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE | 0 | 1 | 2 | 1 | 2 | 0 | 3 | 2 |

SUBJECT CHEMISTRY – Paper 032

PROFICIENCY GENERAL

REGISTRATION NUMBER | | | | | | | | | | |

SCHOOL/CENTRE NUMBER					

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH | D | D | M | M | Y | Y | Y | Y |

SIGNATURE _____

DO NOT WRITE ON THIS PAGE

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JANUARY 2018

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

CHEMISTRY

Paper 032 – General Proficiency

Alternative to SBA

2 hours and 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
5. You may use a silent, non-programmable calculator to answer questions.
6. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
7. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Answer ALL questions.

Write your responses in the spaces provided in this booklet.

1. (a) Concentration, temperature, surface area and catalysts all affect the rate of a chemical reaction. In this experiment you will be investigating the effect of concentration on the rate of a reaction. Different concentrations of aqueous sodium thiosulfate, $Na_2S_2O_3$, will be allowed to react with a fixed concentration of dilute hydrochloric acid, HCl, as shown in Table 1 **on page 6**. The reaction vessel is to be placed on top of a cross, marked on a piece of paper. This reaction produces colloidal sulfur which makes the reaction mixture turn opaque and the cross disappear. The time taken for the cross to disappear should be noted.

The reaction occurring in the experiment is as follows:

$$Na_2S_2O_3(aq) + 2HCl(aq) \rightarrow S(s) + SO_2(g) + 2NaCl(aq) + H_2O(l) \qquad \text{(Equation 1)}$$

Materials:

You are provided with the following:

- **Solution 1**: 200 cm^3 of aqueous 0.2 mol dm^{-3} sodium thiosulfate, $Na_2S_2O_3$
- **Solution 2**: 300 cm^3 of 0.1 mol dm^{-3} hydrochloric acid, HCl
- Two measuring cylinders labelled **1** and **2**
- Two 200 cm^3 beakers
- One glass rod
- A piece of paper with a cross marked on it
- A stopwatch

GO ON TO THE NEXT PAGE

Procedure:

1. Rinse the measuring cylinder labelled **1** with approximately 5 cm^3 of **Solution 1**.

2. Rinse the measuring cylinder labelled **2** with approximately 5 cm^3 of **Solution 2**.

3. (i) Using measuring cylinder labelled **1**, measure out 50 cm^3 of **Solution 1** into the empty beaker provided.

   (ii) Place the beaker on the paper with the cross.

   (iii) Using the measuring cylinder labelled **2**, measure out 50 cm^3 of **Solution 2**.

   (iv) Pour the 50 cm^3 of **Solution 2** into the beaker on the paper with the cross and start the stopwatch. Stir the contents with the glass rod provided three (3) times then leave undisturbed.

   (v) View the cross from above the liquid in the beaker and stop the stopwatch as soon as the cross disappears.

   (vi) Record the time in the appropriate space for Experiment 1 in Table 1 **on page 6**.

4. Repeat Steps 3 (i) to 3 (vi) for Experiments 2–5, but with the appropriate volumes of **Solution 1**, **Solution 2** and DISTILLED WATER indicated in Table 1 **on page 6**. Use the measuring cylinder labelled **1** to measure the volume of distilled water.

NOTE: The beaker MUST be washed with distilled water between experiments. Drain the excess water from the beaker. THERE IS NO NEED TO DRY THE BEAKER.

TABLE 1: RESULTS OF EXPERIMENTS 1–5

Experiment	Volume of 0.2 mol dm^{-3} $Na_2S_2O_3$ (cm^3)	Volume of Distilled Water (cm^3)	Volume of 0.1 mol dm^{-3} HCl (cm^3)	$[Na_2S_2O_3]$ (mol dm^{-3})	Time (s)	Reciprocal Time (s^{-1})
1	50	0	50	0.10		
2	40	10	50	0.08		
3	30	20	50	0.06		
4	20	30	50	0.04		
5	10	40	50	0.02		

(7 marks)

(b) From the times taken in Experiments 1–5, calculate the reciprocal times and record them in the appropriate spaces in Table 1. **(5 marks)**

(c) On the axes provided in Figure 1 **on page 7**, plot a graph of the reciprocal times versus concentration of $Na_2S_2O_3$ for Experiments 1–5 , and draw the best straight line through the points. **(7 marks)**

(d) Based on the graph drawn **on page 7**, determine and record the effect of concentration of aqueous $Na_2S_2O_3$ on the rate of reaction.

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(2 marks)

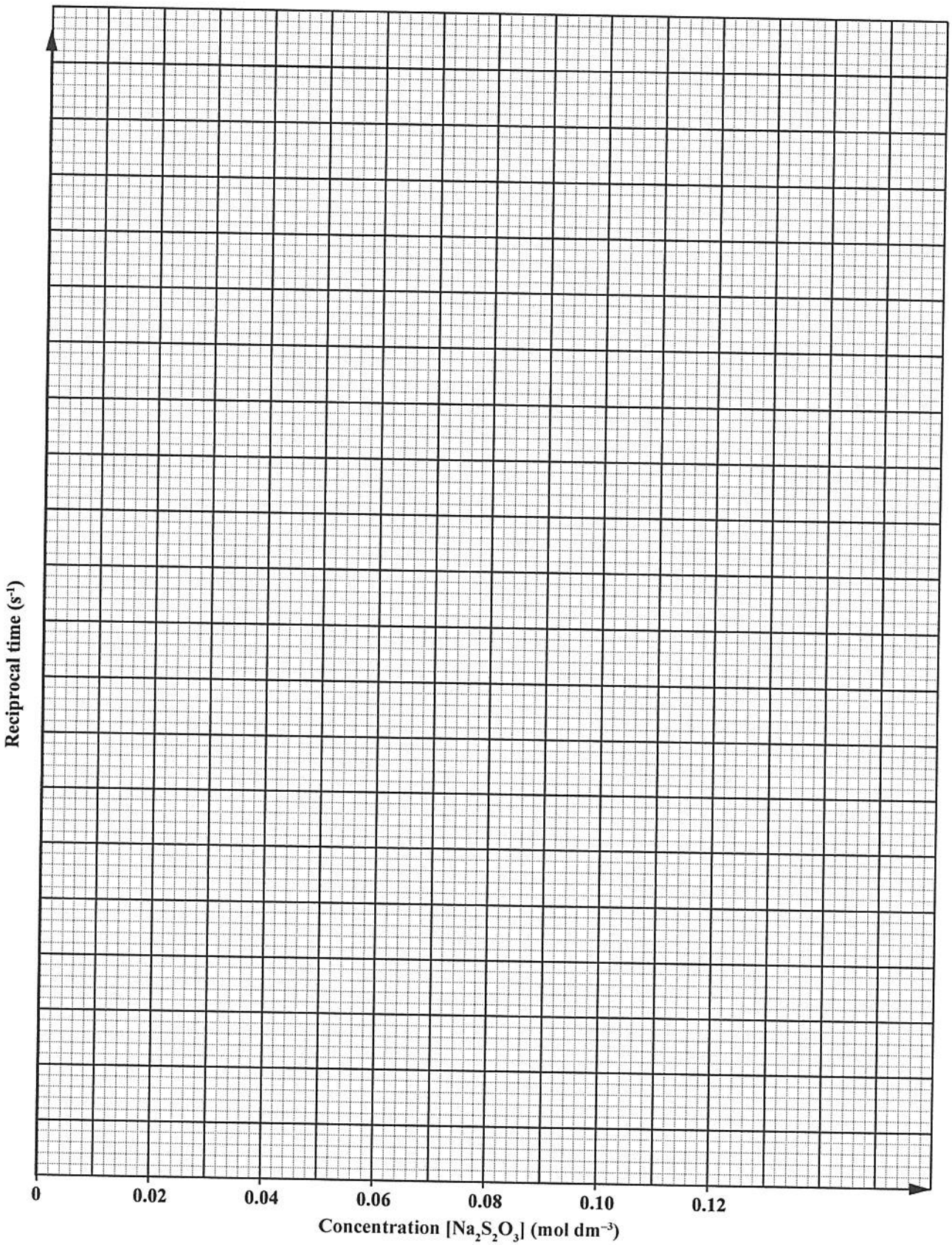

Figure 1. Graph of reciprocal time versus Concentration

(e) Calculate the number of moles of $Na_2S_2O_3$ used in Experiment 1.

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(2 marks)

(f) If the reaction in Experiment 1 was allowed to reach completion, calculate the mass of sulfur that would be precipitated.

[RAM: S = 32.0]

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(3 marks)

Total 26 marks

NOTHING HAS BEEN OMITTD.

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2. A student carried out the following tests on two solutions, X and Y, and made the inferences recorded in Table 2. Complete Table 2 to show ALL possible observations.

TABLE 2: RESULTS OF QUALITATIVE ANALYSIS ON SOLUTIONS X AND Y

	Test	Observation	Inference
(a)	To a portion of **Solution X**, aqueous sodium hydroxide is added slowly until in excess.	• • **(2 marks)**	Al^{3+}, Pb^{2+}, or Zn^{2+} ions are present.
(b)	To another portion of **Solution X**, aqueous potassium iodide is added.	• **(1 mark)**	Pb^{2+} ions are absent.
(c)	To another portion of **Solution X**, aqueous ammonia is added until in excess.	• • **(2 marks)**	Zn^{2+} ions are present.
(d)	To another portion of **Solution X**, aqueous silver nitrate is added, followed by aqueous ammonia.	• • **(2 marks)**	Cl^- ions are present.

	Test	Observation	Inference
(e)	To a portion of **Solution Y**, aqueous sodium hydroxide is added dropwise until in excess.	• • **(2 marks)**	Fe^{2+} ions are present.
(f)	To another portion of **Solution Y**, aqueous barium chloride acidified with dilute HCl is added.	• **(1 mark)**	SO_4^{2-} ions are present.

Total 10 marks

3. Metals **A** and **B** are two unknown metals. Plan and design an experiment to determine which of the two metals, **A** or **B**, is more reactive. The hypothesis is given below.

Hypothesis: Metal **A** is more reactive towards acids than Metal **B**.

Your answer should include the following:

(a) Apparatus and materials

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(2 marks)

(b) Procedure

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(3 marks)

(c) TWO variables to be controlled

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(2 marks)

(d) Data to be collected, presented in a tabular form

(2 marks)

(e) Discussion of the results as they relate to the hypothesis

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(1 mark)

(f) ONE possible source of error

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(1 mark)

(g) ONE precaution to be taken during the experiment

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(1 mark)

Total 12 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. ☐

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WRITE ON
THIS PAGE

CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE:

1. **Fill in all the information requested clearly in capital letters.**

TEST CODE: | 0 | 1 | 2 | 1 | 2 | 0 | 3 | 2 |

SUBJECT: CHEMISTRY – Paper 032

PROFICIENCY: GENERAL

REGISTRATION NUMBER: | | | | | | | | | | |

FULL NAME: _____

(BLOCK LETTERS)

Signature: _____

Date: _____

2. **Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.**

3. **Keep it in a safe place until you have received your results.**

INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: _____

Supervisor/Invigilator

Date: _____

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