CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

02 MAY 2022 (p.m.)

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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

FORM TP 2022057

TEST CODE 01212032

MAY/JUNE 2022

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

CHEMISTRY

Paper 032 – General Proficiency

ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

2 hours 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.

NOTHING HAS BEEN OMITTED.

Answer ALL questions.

1. You are required to determine the concentration of iron(II) sulfate solution by reacting it with a known concentration of potassium manganate(VII) using a titration method.

You are provided with the following reagents.

- **Solution X** which contains 0.010 (as in ISS and SUPR) mol dm^{-3} of aqueous potassium manganate(VII), $KMnO_4$ solution
- **Solution Y** which contains an unknown concentration of iron(II) sulfate, $FeSO_4$

Procedure

1. Rinse the burette with a small amount of **Solution X**.
2. Fill the burette with **Solution X** and record the burette reading in Table 1.
3. Rinse the pipette with a small amount of **Solution Y**.
4. Pipette 25.0 cm^3 of **Solution Y** into a conical flask.
5. Titrate **Solution X** in the burette against **Solution Y** in the conical flask. Note the volume of **Solution X** used at the end point when the mixture turns a pale pink colour. Record the burette reading in Table 1.
6. Repeat the experiment until TWO consistent results are obtained, but do NO MORE than THREE titrations.

(a) Record your volume readings to 2 decimal places in Table 1.

TABLE 1: TITRATION OF SOLUTION X WITH SOLUTION Y

Burette Readings (cm^3)	**Titration 1**	**Titration 2**	**Titration 3**
Final volume			
Initial volume			
Volume of **Solution X** used			

(9 marks)

(b) In Table 1, indicate using asterisks (*) the titration volumes that will be used to calculate the average volume of **Solution X**. **(1 mark)**

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(1 mark)

(d) Calculate the number of moles of MnO_4^- in **Solution X** used in the titration.

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(2 marks)

(e) Given that the equation for the reaction is:

$$MnO_4^-(aq) + 8H^+(aq) + 5Fe^{2+}(aq) \rightarrow Mn^{2+}(aq) + 4H_2O(l) + 5Fe^{3+}(aq)$$

Calculate the number of moles of Fe^{2+} that was used in the reaction with **Solution Y**.

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(2 marks)

(f) Calculate the concentration of iron(II) sulfate.

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(2 marks)

GO ON TO THE NEXT PAGE

(g) From your equation in part (e), deduce the following

(i) The oxidation state of Mn in MnO_4^-

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(2 marks)

(ii) The change in oxidation of Fe^{2+}

.....

.....

(1 mark)

(iii) The oxidizing and reducing agent.

Reducing agent .....

Oxidizing agent .....

(2 marks)

(h) State TWO safety precautions that should be taken when conducting this experiment.

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(2 marks)

(i) State ANY TWO procedural steps that were used to minimize any experimental errors.

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(2 marks)

Total 26 marks

Complete Table 2 to show all possible observations that led to the inferences.

TABLE 2: RESULTS OF QUALITATIVE ANALYSIS ON SOLUTIONS C AND D

	Test	Observation	Inference
(a)	To a portion of **solution of C**, aqueous sodium hydroxide was added dropwise.	• .... **(1 mark)**	Al^{3+}, Zn^{2+}, Pb2+, or Ca^{2+} ions possibly present.
	The aqueous solution of sodium hydroxide was further added until in excess	• .... **(1 mark)**	Al^{3+}, Zn^{2+}, or Pb^{2+} ions possibly present
(b)	To a portion of **solution of C**, aqueous ammonia solution was added dropwise.	• .... **(1 mark)**	Pb^{2+}, or Zn^{2+}, or Al^{3+} ions possibly present.
	The aqueous ammonia solution was further added until in excess	• .... **(1 mark)**	Zn^{2+} or Pb^{2+} ions possibly present
(c)	A few drops of potassium iodide was added to **solution of C**, in a clean test tube.	• .... **(1 mark)**	Pb^{2+} ions present.

	Test	Observation	Inference
(d)	To a portion of **solution of D**, aqueous ammonia was added dropwise.	• .... **(1 mark)**	Fe^{3+} ions present
(e)	To a portion of **solution of D** in a clean test tube, aqueous barium chloride was added. Dilute HCl was added to the test tube.	• .... **(1 mark)** • .... **(1 mark)**	SO_4^{2-} ions present
(f)	To a **solution of D** in a test tube aqueous lead (II) nitrate was added, followed by dilute HNO_3.	• .... • .... **(2 marks)**	SO_4^{2-} ions confirmed

Total 10 marks

at the local supermarket. The rainwater collected from the industrial area contains high levels of dissolved atmospheric carbon dioxide.

You are required to plan and design an experiment to determine which water sample is rainwater.

Your answer should include the following:

(a) Hypothesis

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(1 mark)

(b) Aim

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(1 mark)

(c) Procedure

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(2 marks)

(d) Apparatus and materials

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(2 marks)

(e) ONE variable to be controlled

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(1 mark)

(f) Data to be collected

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(1 mark)

(g) Discussion of the results as they relate to the hypothesis.

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(3 marks)

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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. [ ]

Question No.

DO NOT WRITE ON THIS PAGE

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 yo 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 bookl collected by you.

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

Signature: _____
Supervisor/Invigilator

Date: _____