CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

19 JANUARY 2021 (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

032

PROFICIENCY GENERAL

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

SCHOOL/CENTRE NUMBER

NAME OF SCHOOL/CENTRE

A001

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

DATE OF BIRTH | | | | | | | | |

SIGNATURE _____

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FORM TP 2021006

TEST CODE 01212032

JANUARY 2021

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

CHEMISTRY

Paper 032 – General Proficiency

Alternative to School-Based Assessment

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.

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NOTHING HAS BEEN OMITTED.

Answer ALL questions.

Write your responses in the spaces provided in this booklet.

1. Chemical reactions are always accompanied by energy changes. When the energy change is in the form of heat, reactions can be investigated by using temperature measurements. You are required to determine the value of the enthalpy change that accompanies a neutralization reaction.

You are provided with the following chemicals and apparatus:

- A solution of 0.5 mol dm^{-3} sodium hydroxide
- A solution of 0.5 mol dm^{-3} sulfuric acid
- A thermometer (0–100 °C) (0.5 °C gradations)
- An 8 oz calorimeter (with a small hole to insert the thermometer)
- A measuring cylinder (100 cm^3)
- A stop-watch
- A wash bottle with distilled water

Procedure

(i) Measure 100 cm^3 of the sodium hydroxide solution and pour it into the calorimeter.

(ii) Place the lid on the calorimeter; insert the thermometer through the lid and stir. Start the stop-watch.

(iii) Record the temperature for the first 4 one-minute intervals in Table 1, **on page 6**.

(iv) Rinse the measuring cylinder and measure 50 cm^3 of the sulfuric acid.

(v) On the fifth minute, remove the lid and the thermometer, and add the 50 cm^3 of sulfuric acid solution to the calorimeter.

(vi) Replace the lid on the calorimeter; insert the thermometer through the lid and stir.

(vii) Record the temperature at the sixth minute and at every one-minute interval up to ten minutes, in Table 1.

GO ON TO THE NEXT PAGE

(a) **TABLE 1: TIME–TEMPERATURE DATA**

Time (min.)	Temperature (°C)
1.0	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	
9.0	
10.0	

(5 marks)

(b) (i) Using the axes provided in Figure 1, **on page 7**, plot a graph of temperature against time using the data in Table 1. Draw a smooth curve through the points on the graph. **(6 marks)**

(ii) From your graph, calculate the change in temperature (ΔT), for the reaction taking place in the experiment.

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(1 mark)

(iii) State whether the reaction is exothermic or endothermic.

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(1 mark)

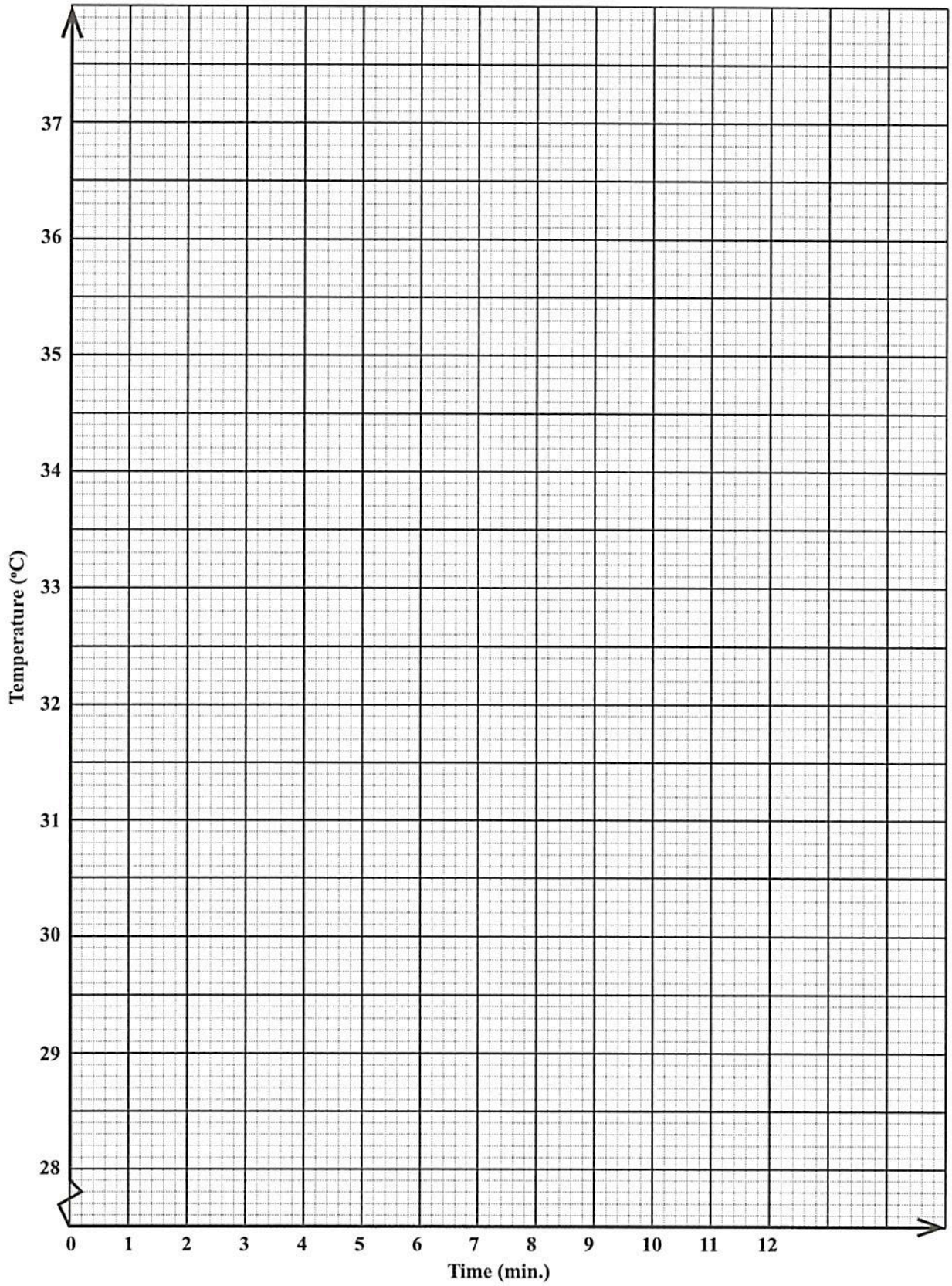

Figure 1. Temperature against time

(c) (i) Write a balanced equation for the reaction occurring in the experiment.

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(2 marks)

(ii) Calculate the number of moles of sulfuric acid in the 50 cm^3 of 0.5 mol dm^{-3} sulfuric acid solution that was used in the reaction.

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(2 marks)

(iii) Determine the number of moles of water that was produced in the reaction.

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(2 marks)

(d) (i) The final solution has a mass (m) of 153 g and a specific heat capacity (c) of 3.82 $Jg^{-1}\,°C^{-1}$. Using your answer in (b) (ii), calculate the heat change (E) for the reaction, given that $E = m\,c\,\Delta T$.

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(2 marks)

(ii) Calculate the enthalpy change for the reaction.

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(2 marks)

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(e) (i) Suggest TWO ways in which the experiment could have been affected if it was carried out using an uncovered glass beaker instead of a calorimeter.

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(2 marks)

(ii) State ONE precaution that should be taken when stirring the reaction mixture.

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(1 mark)

Total 26 marks

2. Remi and Rehanna conducted an investigation involving the electrolysis of copper(II) sulfate using copper electrodes. The mass of the cathode was recorded at various time intervals and the actual mass of the copper deposited was calculated. Table 2 shows the experimental results.

TABLE 2: EXPERIMENTAL RESULTS

Time (s)	Mass of Cathode (g)	Actual Mass of Copper Deposited (g)
0	11.80	0
5	11.83	0.03
10	11.85	0.05
15	11.87	0.07
20	11.89	0.09
25	11.91	0.11

(a) (i) Using the data in Table 2, plot a graph of actual mass of copper deposited against time on the grid provided in Figure 2, **on page 11.** Use appropriate scales on the grid and plot a line of best fit. **(6 marks)**

(ii) Draw a labelled diagram to show the electrolytic cell that would be used for carrying out this investigation.

(4 marks)

Total 10 marks

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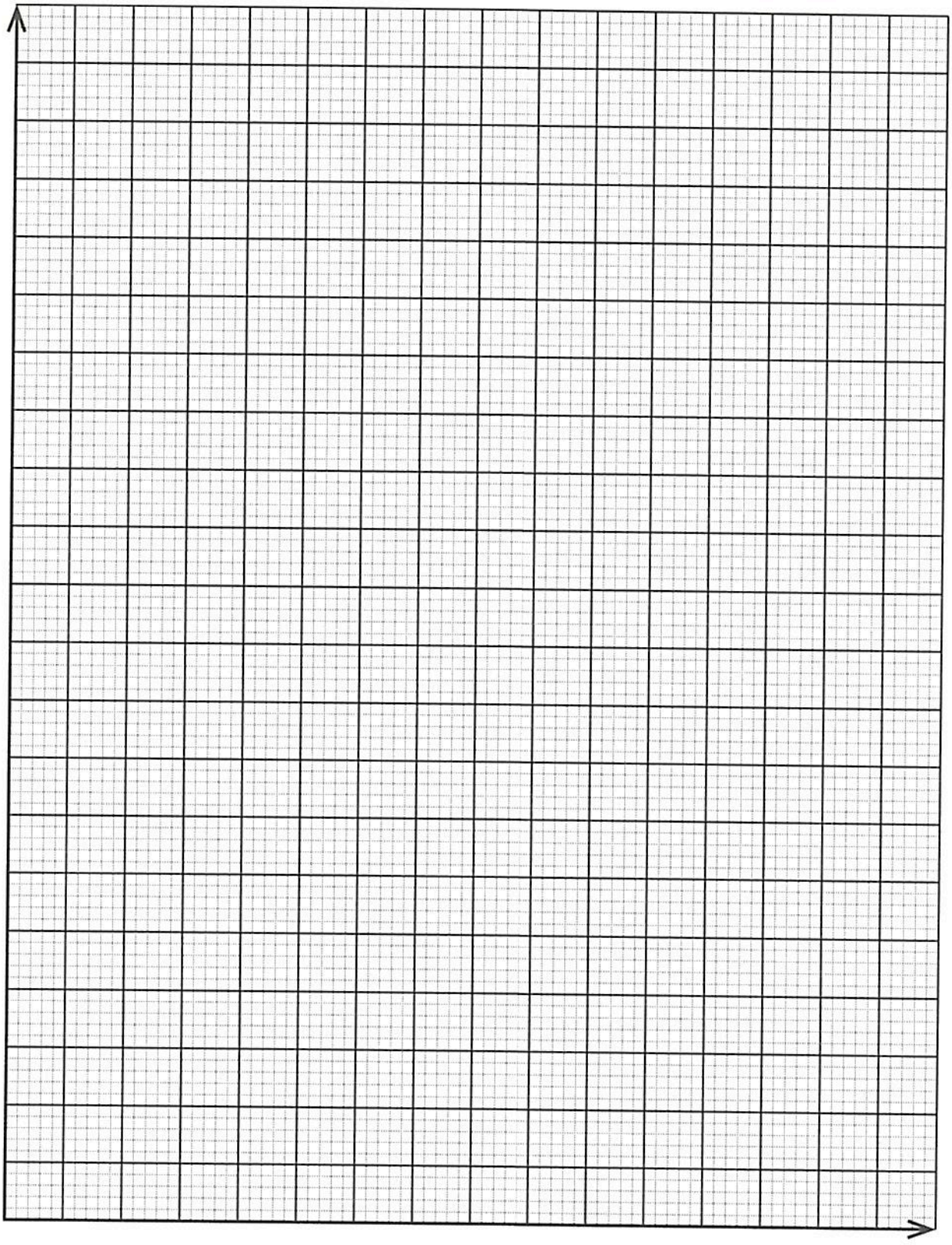

Figure 2. Actual mass of copper deposited against time

3. A man was suspected of defacing a wall at his workplace with water-soluble paint. After searching his office, a can of water-soluble paint was discovered in his desk. However, one of the investigators thought that the paint on the wall looked somewhat different when compared to the paint in the can.

Plan and design an experiment that could assist the investigators in determining if the paints are indeed different.

In your response include the following:

(a) Hypothesis

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(1 mark)

(b) Procedure

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(3 marks)

(c) Apparatus and materials

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(2 marks)

(d) Variables to be controlled

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(2 marks)

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(e) Data to be collected

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(2 marks)

(f) Discussion

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(2 marks)

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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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: _____