# CARIBBEAN EXAMINATIONS COUNCIL

## CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

08 MAY 2017 (p.m.)

M1701212032

## 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

SIGNATURE

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**CARIBBEAN EXAMINATIONS COUNCIL**

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

**CHEMISTRY**

**Paper 032 – General Proficiency**

**ALTERNATIVE TO SCHOOL-BASED ASSESSMENT**

*2 hours 10 minutes*

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### 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.**

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**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)  You are required to determine the percentage of iron in an iron(II) salt.

    You are provided with THREE solutions:

    •   **Q** is a solution of the iron(II) salt. It was prepared by dissolving 39.3 g of the salt in 1 $dm^3$ of distilled water.

    •   **R** is a 0.020 mol $dm^{-3}$ $KMnO_4$ solution.

    •   $H_2SO_4$ of concentration 2 mol $dm^{-3}$.

    Procedure:

    1.  Rinse the burette with a small amount of solution **R**.

    2.  Place solution **R** in the burette provided.

    3.  Rinse the pipette with a small amount of solution **Q**.

    4.  Pipette 25 $cm^3$ (20 $cm^3$) of solution **Q** into a 250 $cm^3$ conical flask.

    5.  Using a measuring cylinder, add 25 $cm^3$ of 2 mol $dm^{-3}$ $H_2SO_4$ to the conical flask and swirl to ensure mixing.

    6.  Titrate the contents of the flask with solution **R**. While titrating, swirl the flask until the first appearance of a permanent pink colour.

    7.  Record your results in Table 1 **on page 5**.

    8.  Repeat the experiment until consistent results are obtained but DO NO MORE than THREE titrations.

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Results:

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

**TABLE 1: TITRATION RESULTS**

| Burette Readings ($cm^3$) | Titration 1 | Titration 2 | Titration 3 |
|---|---|---|---|
| Final volume | | | |
| Initial volume | | | |
| Volume of solution **R** used | | | |

**(10 marks)**

Pipette volume used: _____ $cm^3$

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

(iii) Hence, determine the average volume of solution **R** that is required to react with 25 $cm^3$ (20 $cm^3$) of solution **Q**.

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**(1 mark)**

Treatment of Results:

Use the results recorded in Table 1 to answer questions (iv) to (x). For **all calculations**, report your results to 2 decimal places.

The ionic equation for the reaction between solutions **Q** and **R** is as follows:

$$5Fe^{2+} (aq) + MnO_4^- (aq) + 8H^+ (aq) \rightarrow 5Fe^{3+} (aq) + Mn^{2+} (aq) + 4H_2O \ (l)$$
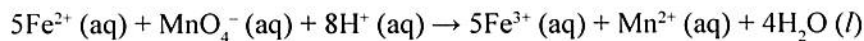
(iv)    Identify the type of reaction taking place.

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**(1 mark)**

(v)    What is the mole ratio of $Fe^{2+}$ to $MnO_4^-$?

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**(1 mark)**

(vi)    Calculate the number of moles of $KMnO_4$ in the average volume of solution **R** used in the titration.

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**(1 mark)**

(vii)    Calculate the number of moles of $Fe^{2+}$ in 25 cm³ (20 cm³) of solution **Q**.

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**(1 mark)**

(viii)    Calculate the mass of iron in 25 cm³ (20 cm³) of solution **Q**.

[Relative atomic mass of Fe is 55.85]

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**(1 mark)**

GO ON TO THE NEXT PAGE

(ix)    Calculate the mass of iron in 1 dm³ of solution **Q**.

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**(1 mark)**

(x)    Calculate the percentage by mass of iron in the iron(II) salt used to make solution **Q**.

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**(1 mark)**

(b)     Conduct the following tests on solution **T**.  Record your observations and inferences in Table 2.

### TABLE 2: RESULTS OF TESTS ON SOLUTION T

| Test | Observation | Inference |
|---|---|---|
| (i)   To a small portion of **T**<br><br>• add two drops of NaOH | •<br><br><br>**(1 mark)** | •<br><br><br>**(1 mark)** |
| • add NaOH until in excess | •<br><br><br>**(1 mark)** | •<br><br>[Ionic Equation Required]<br>**(2 marks)** |
| (ii)  To another small portion of **T**<br><br>• add three drops of silver nitrate and three drops of dilute HNO₃ | •<br><br><br>**(1 mark)** | •<br><br><br>**(1 mark)** |

**Total 26 marks**

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2.	A student sets out to investigate the effect of temperature on the time taken, $t$, to completely react a piece of magnesium metal with acid.

Figure 1 shows the actual thermometer readings and the corresponding times taken for the reaction to occur.



**EXPT #1**

**EXPT #2**

**EXPT #3**

Time:	2.1 min	1.7 min	1.5 min

**EXPT #4**

**EXPT #5**

Time:	1.2 min	0.7 min
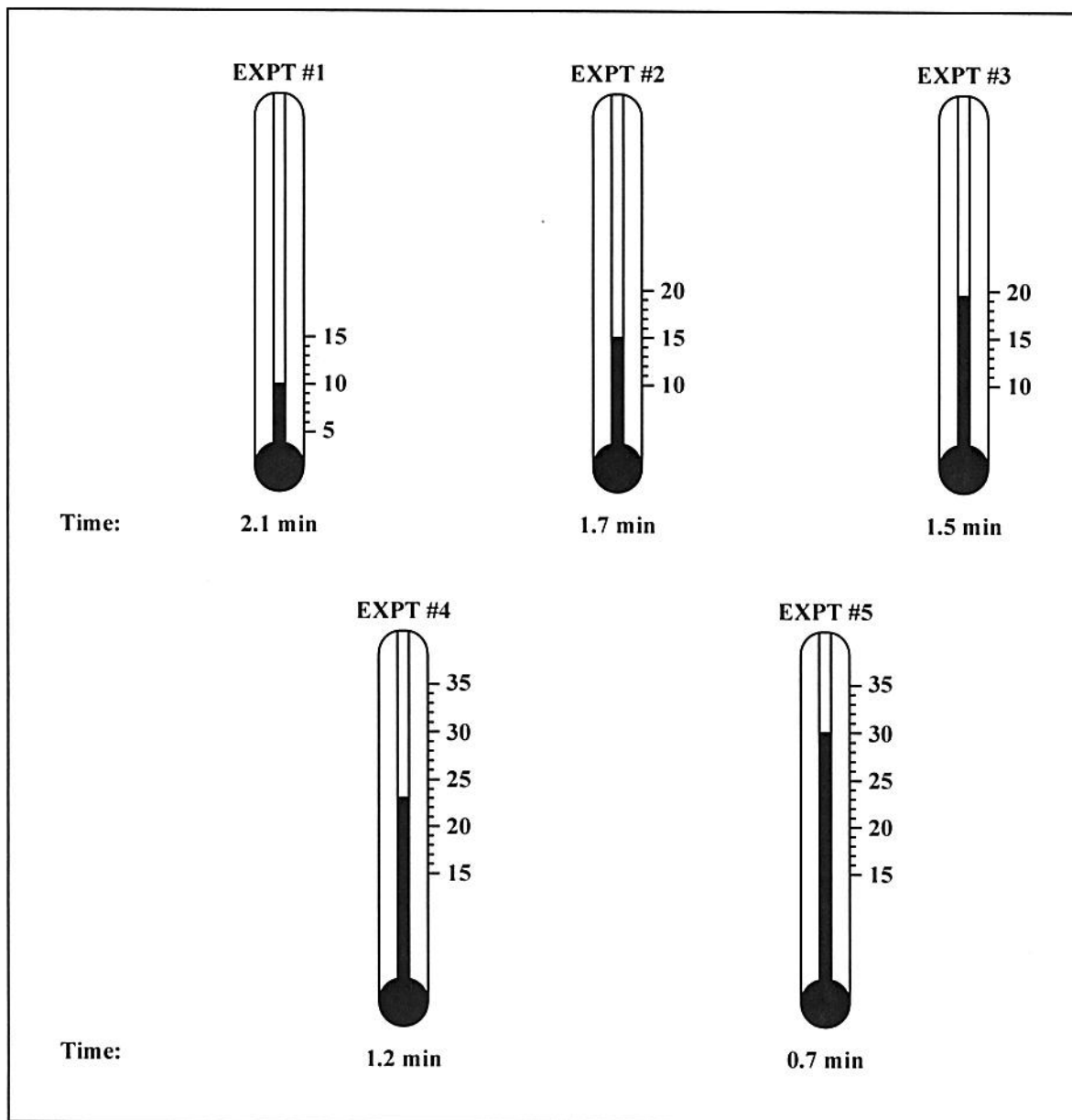
**Figure 1: Temperature and time taken for the reaction**

Use the information in Figure 1 to answer the following questions.

(a)     Complete Table 3 by inserting the temperature readings from Figure 1 **on page 9** at the appropriate times.

**TABLE 3: TEMPERATURE AND TIME TAKEN FOR MAGNESIUM TO REACT**

| Experiment | Temperature (°C) | Time taken, $t$ (min) |
|---|---|---|
| 1 | | 2.1 |
| 2 | | 1.7 |
| 3 | | 1.5 |
| 4 | | 1.2 |
| 5 | | 0.7 |

**(5 marks)**

(b)     Using the axes provided in Figure 2 **on page 11**, plot a graph of time, $t$, in minutes versus temperature in °C. Circle the plotted points on the graph $\otimes$, and draw the line of best fit.

**(5 marks)**

**Total 10 marks**

Time, *t* (min)

0          1          2          3

Temperature (°C)

0

10

20

30

40
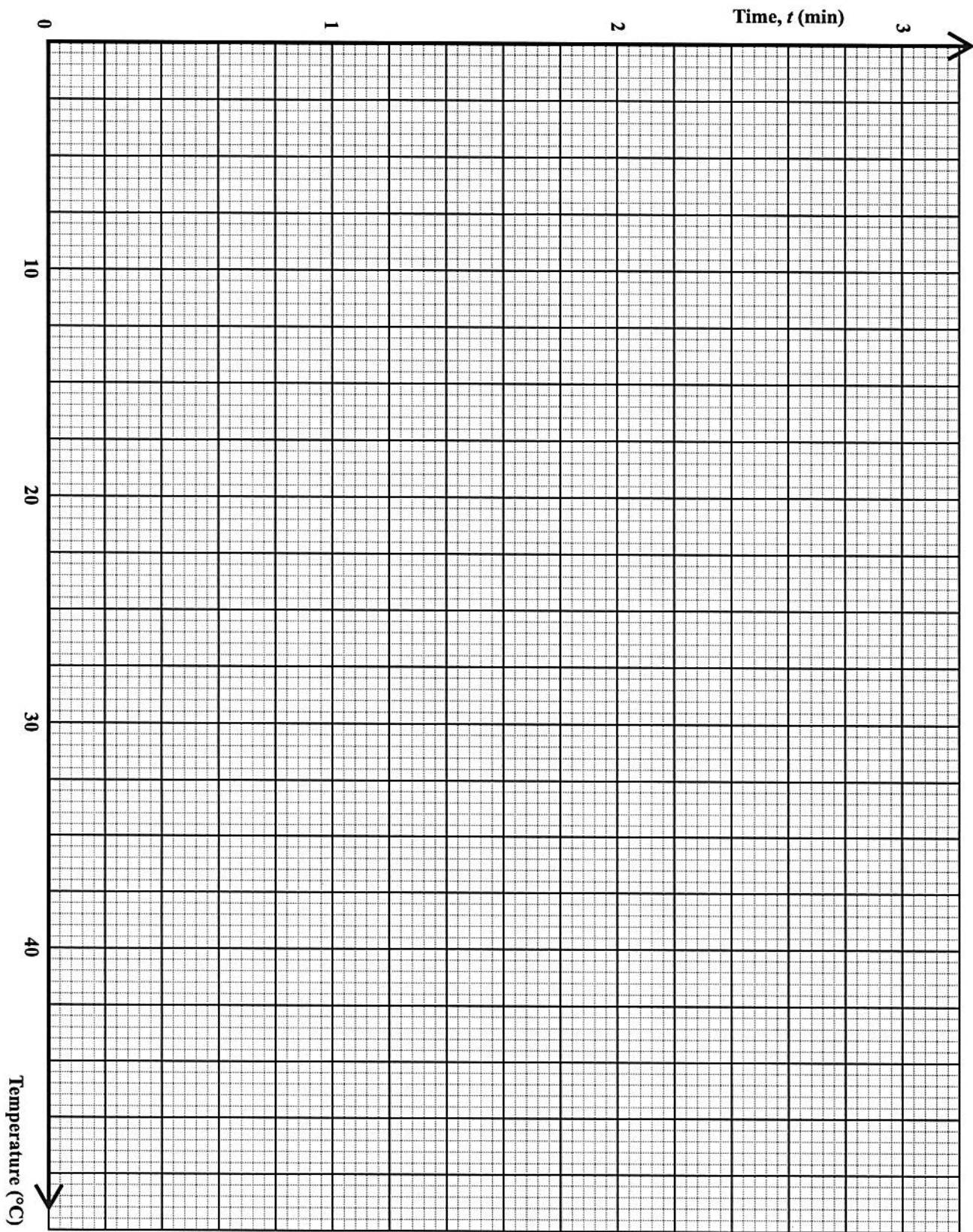
**Figure 2: Graph of time in minutes versus temperature in °C**

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3. Inkquill and InkBarn are two competing ink maufacturing companies. Inkquill claims that its water soluble black ink is richer in colour than InkBarn's water soluble black ink. You have been hired as an independent consultant to determine whether Inkquill's claim is true.

Plan and design an experiment to determine whether Inkquill's claim is true. The hypothesis is given below.

Hypothesis: The 'richer' black ink contains more components.

Complete your plan and design under the following headings.

(a) Procedure

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**(3 marks)**

(b) Apparatus and materials

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**(2 marks)**

(c) Labelled diagram of experiment set-up

**(2 marks)**

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(d)     Data to be collected

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                                                                                        **(1 mark)**

(e)     Discussion as it relates to the hypothesis

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(f)     TWO precautions to be taken in carrying out the procedure

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                                                                                        **(2 marks)**

(g)     ONE controlled variable

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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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# 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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