Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

CHEMISTRY

6031/2

PAPER 2

NOVEMBER 2022 SESSION

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Data Booklet
Electronic Calculator

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

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*Answer **all** questions*

For Examiner's Use

1 (a) Distinguish, using a diagram, the behaviour of the ions $^{1}_{1}H^{-}$, $^{2}_{1}H^{+}$ and $^{4}_{2}He^{2+}$ in an electric field.

[1]

(b) A gaseous atom of an element, X, loses electrons to form a cation of the element.

(i) Name the chemical change that occurs when X loses electrons.

_____

(ii) Write an equation that represents the chemical change in (i).

_____

[2]

(c) (i) Write the electronic configuration of O^{2-} ion.

_____ [1]



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(ii) Complete **Fig. 1.1**, a sketch graph, to show the variation of successive $\log_{10}$ ionisation energies of O^{2-} ion.

For Examiner's Use

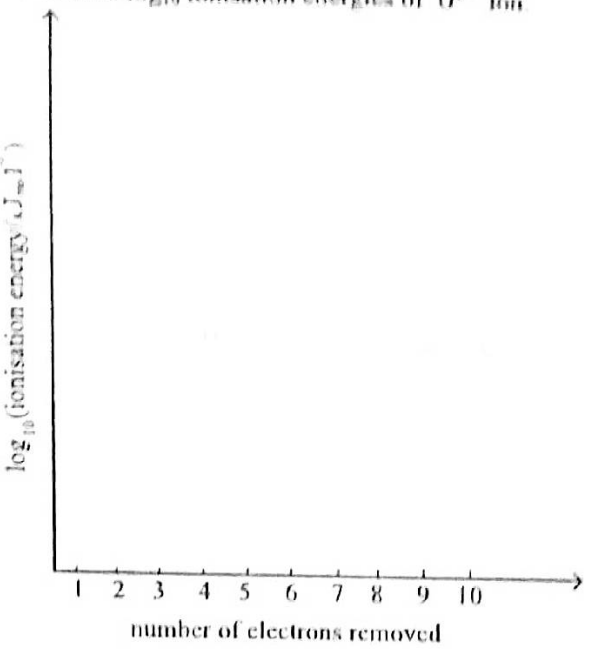


Fig. 1.1

[3]

(d) **Fig. 1.2** shows the mass spectrum of an element **Q**.

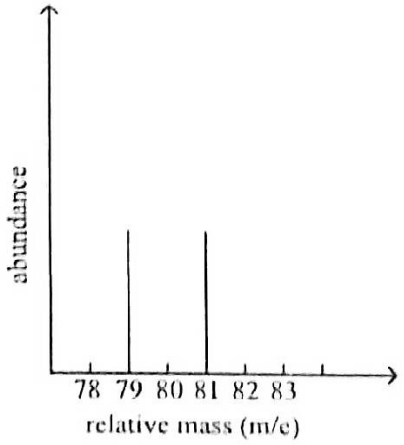


Fig. 1.2

For Examiner's Use

(i) Determine the relative atomic mass of **Q**.

(ii) Eplain why $AgI_{(s)}$ is insoluble in $NH_{3(aq)}$.

[3]

[Total: 10]

2 **(a)** Explain the term

(i) *order of reaction*,

(ii) *rate of reaction*.

[2]



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(b) An experiment was carried out to investigate the kinetics of the reaction shown.

$$H_2O_{2(aq)} + 2I^-_{(aq)} + 2H^+_{(aq)} \rightarrow 2H_2O_{(l)} + I_{2(aq)}$$

Table 2.1 shows the results of the experiment.

Table 2.1

experiment No	volume/cm^3						relative rate/s^{-1}
	H_2O_2	KI	H_2SO_4	NaS_2O_3	H_2O	Starch	
1	20	20	10	3	0	2	2.22×10^{-2}
2	20	10	10	3	10	2	1.11×10^{-2}
3	10	20	10	3	10	2	1.12×10^{-2}
4	10	10	20	3	10	2	5.50×10^{-2}

Determine the order of reaction with respect to

(i) hydrogen peroxide, $H_2O_{2(aq)}$.

(ii) iodide ions, $I^-_{(aq)}$.

(iii) hydrogen ions, $H^+_{(aq)}$.

[3]

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(c) (i) Write a rate equation for the reaction.

_____

(ii) State the species involved in the rate determining step of the reaction mechanism.

_____

_____

(iii) Suggest how the relative rate of the reaction was monitored.

_____

_____

[4]

(d) Explain why the total volume of the mixture was kept constant for all the experiments.

_____

_____ [1]

[Total: 10]

3 (a) Describe the observations made when magnesium burns in oxygen.

_____

_____ [2]

(b) (i) Write a balanced chemical equation for the reaction of magnesium with steam.

_____

(ii) State the trend in solubility of Group (II) oxides.

_____

_____



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(iii) Explain why it is better to treat acid indigestion using a suspension of magnesium hydroxide rather than using calcium hydroxide

_____

_____

_____

_____

[4]

(c) (i) Describe the bonding and structure in

1. CO_2,

_____

2. SiO_2.

_____

[3]

(ii) Give any **one** use of SiO_2.

_____ [1]

[Total: 10]



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4 (a) The structural formula of benzocaine is shown in **Fig. 4.1**.

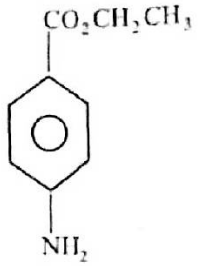


Fig. 4.1

(i) Name any **two** functional groups present in benzocaine.

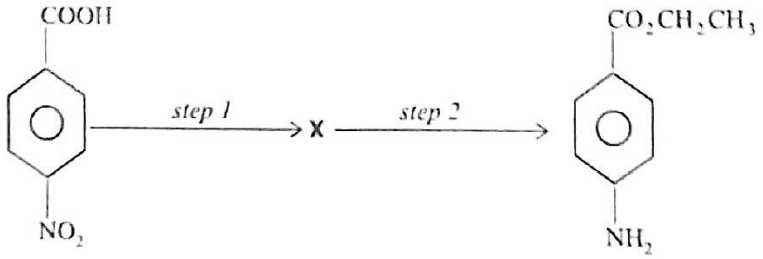
1. _____

2. _____

(ii) Give the structural formulae of the organic products formed when benzocaine is heated in dilute hydrochloric acid.

[4]

(b) Benzocaine can be produced from compound **B** using the reaction scheme shown in **Fig. 4.2**.



compound **B**

Fig. 4.2

(i) Name compound **B**.

_____

For Examiner's Use

(ii) Suggest a possible structure for **X**.

(iii) State the reagents and conditions for steps 1 and 2.

Step 1 reagent(s) _____

conditions _____

Step 2 reagent(s) _____

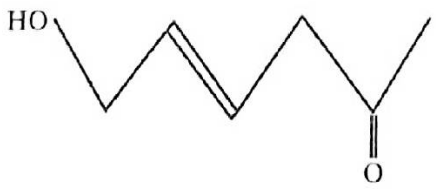
conditions _____ [6]

[Total: 10]

5 (a) Compound **A** is a hydrocarbon with molecular formula C_4H_8.

Draw the displayed structural formulae of the isomers of **A** other than geometrical isomers.

(b) **Fig. 5.1** shows an organic compound **G**.



compound **G**

Fig. 5.1

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For Examiner's Use

(i) Write the structural formulae of the organic products formed when **G** reacts with

1. $SOCl_2$.

2. hot acidified $KMnO_4$.

3. 2,4-DNPH in acidified methanol.

(ii) Name the type of reaction that occurs between **G** and $SOCl_2$.

_____ [5]

(c) Suggest, with a reason, one use of a Platinum Group Metal.

use: _____

reason: _____

_____ [2]

[Total: 10]

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For Examiner's Use

6 (a) Define the term *genetic fingerprinting*.

_____

_____ [1]

(b) Describe how electrophoresis is used to separate DNA fragments.

_____

_____

_____

_____

_____

_____ [4]

(c) Fig. 6.1 shows DNA profile taken from a victim and a crime scene, compared to three suspects.

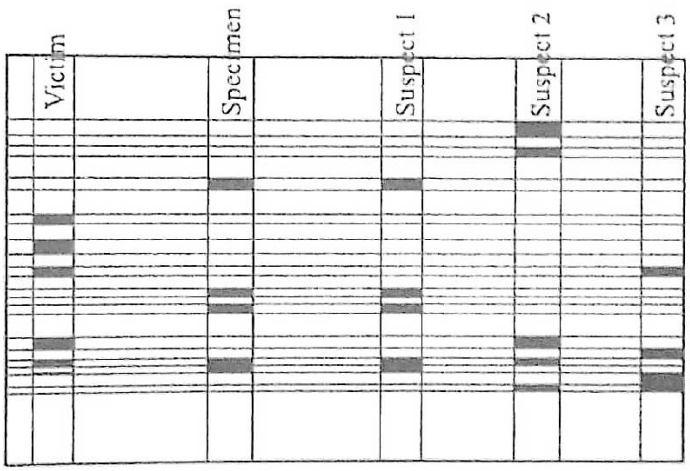


Fig. 6.1

(i) Deduce, with reasons, the suspect who might have committed the crime.

_____

_____ [2]

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(ii) State any other **three** application(s) of genetic fingerprinting.

For Examiner's Use

1. _____

_____

2. _____

_____

3. _____

_____

[3]

[Total:10]

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