Candidate Name ——— ——— ——— ——— ——— Centre Number Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

CHEMISTRY

6031/2

PAPER 2

JUNE 2023 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*

1 (a) (i) State any **two** assumptions of the Kinetic theory of gases.

1. _____

_____

2. _____

_____

(ii) A volume of 46.00 cm^3 of vapour was produced when 0.16 g of a liquid, Y, was vapourised at a temperature of 100 °C and a pressure of 1.02×10^5 Pa.

Calculate the relative molecular mass of Y.

(iii) Describe the arrangement of particles in Y.

_____

_____

_____ [5]

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(b) Hydrogen bromide decomposes according to the equation:

$$2HBr_{(g)} \rightleftharpoons H_{2(g)} + Br_{2(g)}$$

Table 1 shows results of the decomposition of HBr.

Table 1

substance	mole fraction
HBr	0.40
Br_2	0.03
H_2	0.03

(i) Write the K_p expression for the equilibrium reaction.

(ii) Calculate K_p for decomposition of hydrogen bromide.

(iii) Deduce the effect of increasing temperature on the position of the equilibrium.

[5]

[Total:10]

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2 (a) (i) Give the electronic configuration of S^{2-}.

_____

(ii) Describe the shapes of the *s* and *p* orbitals.

s _____

p _____

(iii) The chemical equation for the reaction of tin and nitric acid is shown:

$$Sn + 4HNO_3 \rightarrow SnO_2 + 4NO_2 + 2H_2O$$

Explain using changes in oxidation states the reaction occurring in nitrogen.

_____

_____ [5]

(b) A standard cell was set up using sodium iodide and hydrogen peroxide.

(i) State the type of electrodes appropriate for the reaction.

_____

(ii) Write the half equations and the overall equation for the cell.

_____

_____

_____

(iii) Predict the feasibility of the reaction.

_____

_____

_____

_____ [5]

[Total:10]

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3 (a) Explain why

(i) $NaCl$ is a solid whereas SCl_2 is a liquid at room temperature,

(ii) first ionisation energy of Mg is higher than that of Al,

(iii) SiO_2 is insoluble in water.

[6]

(b) Write balanced chemical equations for the **four** steps of the contact process.

1.

2.

3.

4. [4]

[Total:10]

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4 (a) Methylbenzene reacts as shown in **Figure 4.1**.

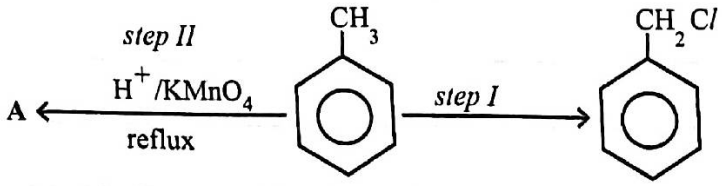


Fig. 4.1

(i) Draw the structure of the organic product **A**.

(ii) State the reagents and conditions for *step 1*.

reagents _____

conditions _____

(iii) State the observation made when methylbenzene reacts with bromine in the presence of $FeBr_3$.

_____

_____

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(iv) Give the structure of the organic product for the reaction in **(iii)**.

[5]

(b) **(i)** Outline the formation of butan-2-one from an alcohol.

_____

_____

(ii) Describe a chemical test for the carbonyl group in butan-2-one.

test _____

_____

observation _____

_____

(iii) Draw the structure of the product for the reaction in **(ii)**.

[5]

[Total:10]

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(a) Explain why butane

(i) does not react with aqueous bromine,

(ii) is insoluble in water,

(iii) has a lower melting point than hexane.

[3]

(b) Describe any **two** environmental effects of the use of alkanes as fuels.

1. _____

2. _____

[2]

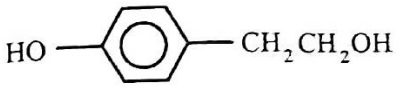
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(c) The structures of compounds **X** and **Y** are shown in **Figure 5.1**.

X



Y

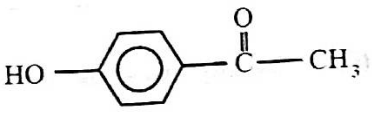


Fig. 5.1

Complete **Table 5.1**. by

(i) stating the observable changes that occur,

(ii) giving the structure(s) of the organic products formed when **X** and **Y** react with sodium metal.

Table 5.1.

	X	**Y**
observation		
structure of organic product		

(iii) Name **one** reagent that can be used to distinguish between compound **X** and compound **Y**.

_____

_____ [5]

_____

[Total:10]

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6 (a) (i) Define a nanoparticle.

(ii) Identify **two** applications of nanoparticles.

(iii) Give **two** examples of nanoparticles.

[5]

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(b) (i) A mixture of three amino acids shown in **Figure 6.1** were separated using electrophoresis buffered at pH 7.

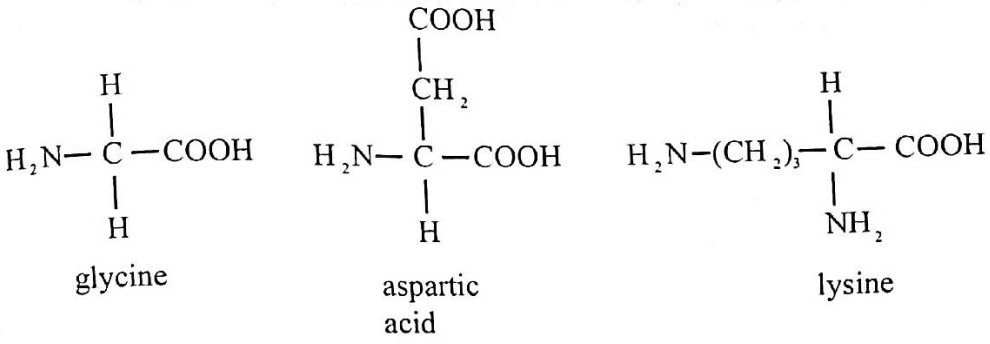


Fig. 6.1

Results obtained with electrophoresis are shown in **Fig. 6.2**.

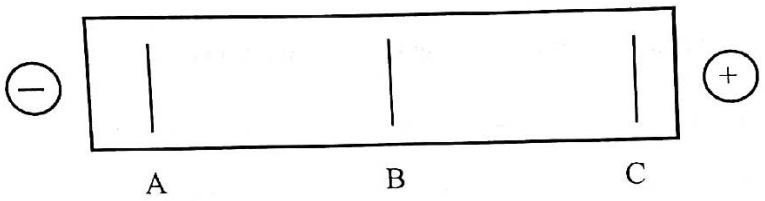


Fig. 6.2

Identify, with reasons, amino acid at A.

1. *amino acid* _____

2. *reason* _____

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(iii) State the overall charge of a zwitterion.

_____

(iii) Write the formula of the peptide formed when glycine reacts with aspartic acid.

(iv) Name the type of reaction between the two amino acids.

_____

_____

[5]

[Total:10]

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