Centre Number	Examination Number	



EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level



Science

Paper 2

Monday

14 NOVEMBER 2022

Additional Materials

Priester Booklet Blechprec steckleiter (post programmatiler) Graph pager Soft pencia (syne & or s10 to recommended) Soft pencia (syne & or s10 to recommended)

Instructions to Candidates

- Write the centre number and your examination number on every page of this question paper and on the separate Answer Booklet/Paper provided.
- 2 There are three sections in this paper; Section A, B and C.
 - (1) Section A

There are twenty questions in this section.

Answer all. For each question, there are four possible answers, A. B. C and D. Choose the best one and mark it with a cross (X) on the Answer Grid provided in this question paper.

(ii) Section B

There are nine questions in this section.

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

(iii) Section C

There are three questions in this section.

Answer any two questions. Write your answers on a separate Answer Booklet/Paper provided.

- 3 At the end of the examination:
 - (i) Enter the numbers of the questions you answered from Section C in the grid crow.
 - (II) Festen the separate Answer Booklet/Pacts use.

 securely to the question paper.

Information for candidates

- Any rough working should be done you ruesuon paper
- 2 The Periodic Table is on page 17.
- 3 Cell phones are not allowed in the extration room.

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- Which of the following best describes why a factory manufacturing pesticides should be located far away from human settlement? Pesticides ...
 - A are poisonous.
 - B contaminate the environment.
 - c destroy buildings.
 - D may kill animals.
- A2 Which of the following is not a basic unit of matter?
 - A Atom
 - B Electron
 - C Ion
 - D Molecule
- A3 Which of the following shows the best order of obtaining salt from a mixture of sand and salt?
 - A Dissolving, filtering, evaporation.
 - B Dissolving, filtering, decantation.
 - C Dissolving, decantation, evaporation.
 - D Dissolving, decantation, crystallisation.
- A4 The best method of separating iron filings from copper powder is ...
 - A filtration.
 - B floatation.
 - C hand picking.
 - D magnetism.
- A5 In which of the following are the greatest intermolecular forces?
 - A Bromine
 - B Chlorine
 - C Fluorine
 - D Iodine
- A6 The following dot and cross diagram represents a compound.





Identify the compound shown in the diagram. The compound is ...

- A magnesium chloride.
- B magnesium oxide.
- c sodium chloride.
- D sodium oxide.

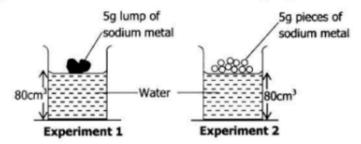
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- Which of the following liquids when added to a strongly acidic solution in the correct amounts could produce a solution with pH of 7?
 - A Distilled water
 - B Ethanoic acid
 - C Lime water
 - D Potassium hydroxide
- A8 What is the identity test of the gas produced when an acid reacts with a carbonate? It ...
 - A puts off the burning splint with a pop sound.
 - B relights the glowing splint.
 - C turns lime water colourless.
 - D turns lime water milky.
- A9 25cm³ of 1.0 mol/dm³ NaOH solution are measured into a 100cm³ volumetric flask and water added to make the solution up to the 100cm³ mark.

The concentration of NaOH in this solution is ...

- A 0.25mol/dm³.
- B 0.025mol.
- C 0.0025mol/dm³.
- D 0.00025mol/dm³.
- A10 What mass of sodium carbonate, Na₂CO₃, is required to make a 250cm³ solution whose concentration is 0.3M?
 - A 7.50g
 - B 7.95g
 - C 10.6g
 - D 15.9g
- A11 An experiment was carried out as shown in the following diagrams.



Where was the reaction faster?

- A In experiment 1
- B In experiment 2
- C In both experiment 1 and 2
- None of the two experiments

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Which of the following best explains why hydrogen (H) is **not** placed in any group on the Periodic Table? It has ...

- A no neutrons.
- B one electron in its shell.
- c properties of both Group I and Group VII elements.
- properties of most of the elements.

A13 The atomic symbols of elements W and Z are as follows;

$$_{19}^{39}$$
W and $_{17}^{35.5}$ Z

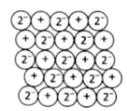
The base units of the compound formed by \boldsymbol{W} and \boldsymbol{Z} are ...

- A atoms.
- B ions.
- C molecules.
- D radicals.

A14 Element **X** is less dense than water and reacts fast with cold water liberating a gas. Which details are correct about element **X**?

	Name of element	Period	Type of solution	Gas produced
A	Beryllium	2	Acidic	Oxygen
В	Caesium	5	Neutral	Hydrogen
С	Calcium	4	Alkaline	Oxygen
D	Sodium	3	Alkaline	Hydrogen
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A15 The following diagram shows the ionic lattice of a substance.



What is this substance likely to be?

- A Magnesium chloride
- B Magnesium oxide
- C Sodium chloride
- D Sodium oxide

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A16 The flowchart shows a commercial manufacture of slaked lime.



What is condition J and substance K?

J

A Catalyst

K Water

B Heat

Oxygen

C Heat

Water

D Oxygen

Carbon dioxide

A17 Which of the following shows the correct method of collection of a dry sample of each of the named gas in the table shown?

	Ammonia	Carbon dioxide	Hydrogen
A	Displacement of water	Upward delivery	Downward delivery
В	Downward delivery	Displacement of water	Upward delivery
С	Upward delivery	Displacement of water	Displacement of water
D	Upward delivery	Downward delivery	Upward delivery

An unsaturated hydrocarbon with six carbon atoms contains only three C=C double bonds. This hydrocarbon is reacted with excess hydrogen at a high temperature.

What is the formula of the resulting hydrocarbon?

- A C₆H₈
- B C₆H₁₀
- C C₆H₁₄
- D C₆H₁₆
- A19 The reactions listed all involve ethanol.
 - 1 CH₃CH₂OH + O₂ →CH₃COOH + H₂O
 - 2 CH₃CH₂OH + CH₃COOH → CH₃COOCH₂CH₃ + H₂O
 - 3 C₆H₁₂O₆ →2CH₃CH₂OH + 2CO₂

Which row correctly describes each reaction?

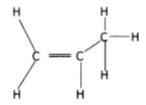
1	2	3
Combustion	Acidification	Fermentation
Combustion	Esterification	Addition
Oxidation	Acidification	Addition
Oxidation	Esterification	Fermentation
	Combustion Oxidation	Combustion Acidification Combustion Esterification Oxidation Acidification

2

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A20 Study the following organic compound.



Why is the compound shown able to decolourise the bromine solution? It ...

- A can dissolve in bromine solution.
- B has a double C=C bond.
- c has a single C C bond.
- b has both single C—C and C—H bonds.

SECTION B: [45 MARKS]

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

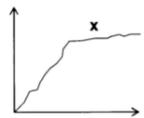
B1 (a) (i) Give **one** reason why laboratory rules are very important.

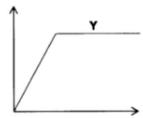
......[1]

(ii) State one importance of chemistry in our day to day life?

.....[1]

(b) The following graphs show heating curves that were drawn after pure ice and candle wax were heated over time to their melting points.





(i) Identify the heating curve for the candle wax and give a reason for your answer.

2

Reason:

.....[1]

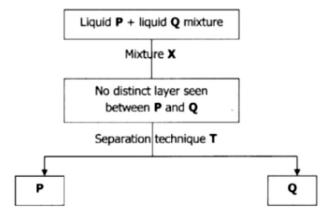
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(ii) Give one effect of impurities on the melting and boiling points of a pure substance.

[Total: 5 marks]

B2 Study the following flowchart and answer the questions that follow.



(a) What are liquids P and Q in mixture X called?

(b) What is the separation technique T? Give the criterion used to separate the mixtures.

Criterion:

.....[1]

(c) Deduce the names of liquids P and Q.

P:[1]

[Total: 5 marks]

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3	The	followin	g symbol shows a nuclide of element A .	
	(a)	elem	nguish between the numbers 16 and 32 shown in the nuclide for ent A given.	
				[2]
	(b)	(i)	To which group of the Periodic Table does element A belong?	[1]
		(ii)	Use the Periodic Table to identify element A.	
				[1]
	(c)	(i)	Draw a dot and cross diagram to show the bonding formed in a compound between element A and hydrogen.	

(ii) Compare the bonding in the compound formed in c(i) with that in calcium oxide.

[1]

[1]

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84 Salts are important substances that have many uses.

(a)	Describe how a fairly dry sample of lead (II) sulphate can be prepared from aqueous sodium sulphate and a soluble compound of lead in the laboratory.	
		[4]
(b)	Suggest the name of another salt that can be prepared in the same way as lead (II) sulphate.	
		[1]

[Total: 5 marks]

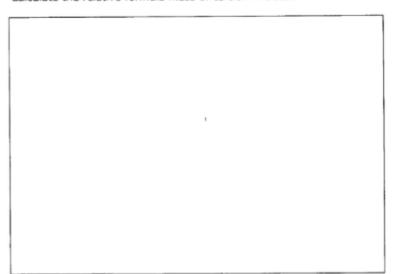
B5 Calcium nitrate decomposes on heating according to the equation:

$$Ca(NO_3)_2 \xrightarrow{\Delta} CaO + NO_2 + O_2$$

(a) Copy the equation given and balance it.

.....[1]

(b) Calculate the relative formula mass of calcium nitrate.



[1]

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(c)		_		cium nitr			7					ume (of ox	ygen	gas	
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Many carbonates decompose to form the metal oxide and carbon dioxide. Table 7.1 shows the mass of the carbonate before and after heating.

	Carbonate	Mass before heating/g	Mass after heating/g
1	Zinc carbonate	2.00	1.30
2	Copper carbonate	2.00	1.29
3	Calcium carbonate	2.00	1.12
4	Iron (II) carbonate	2.00	1.24
5	Potassium carbonate	2.00	2.00
6	Magnesium carbonate	2.00	0.95
	_		

Table 7.1

(a)	Write a balanced chemical equation for the decomposition of zinc carbonate.	
		[1]
(b)	Which carbonate is the most thermally stable? Give a reason for your answer.	
		[2]
(c)	Calcium oxide is produced on a large scale by heating calcium carbonate in a kiln. What environmental problem is associated with large scale production of calcium oxide?	
		[1]
(d)	Select the carbonate which on heating produces a compound which is used as a refractory material.	
		[1]
	[Total: 5 ma	rks]

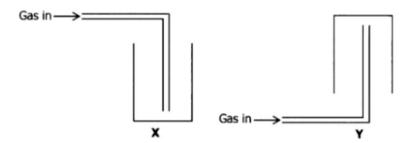
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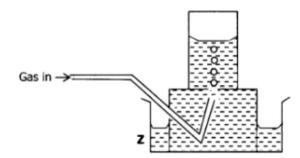
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B8 Three gases A, B and C have properties shown in the table.

Gas	Density	Solubility in water	Appearance
A	More dense than air	Soluble	Colourless
В	Less dense than air	Soluble	Colourless
С	More dense than air	Insoluble	Colourless

Some apparatus used to collect gases are shown in the following diagrams.





- (a) Which apparatus X, Y or Z is most suitable to collect gas

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- (b) Gas C can be collected using apparatus Z.
 - (i) State why apparatus Z is more suitable than apparatus Y to collect gas C?

.....[1]

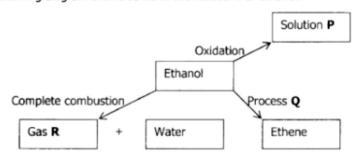
(ii) State why apparatus Y is more suitable than apparatus Z to collect gas B.

(c) Suggest a name of a gas that would be collected using apparatus X.

.....

.....[1] [Total: 5 marks]

B9 The following diagram shows some of the reactions of ethanol.



(a) Draw the structural formula for ethene.

[1]

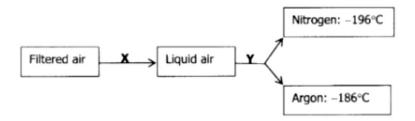
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	((b)	Give t	he names for	
			(i)	solution P;	
					[1]
			(ii)	process Q ;	
		•			[1]
			(iii)	gas R .	
					[1]
	((c)	Write	a balanced chemical equation for the complete combustion of ethanol.	
				[Total: 6 ma	[2]
				[Total: 6 ma	rksj
SEC	TIC	N C:	[20	MARKS]	
Ansv	ver	any tv	vo (2)	questions from this section in the separate Answer Booklet provided.	
C1	ł	nydroc	hloric a us sodi	nent to find the concentration of a solution of sodium hydroxide, 0.1M of acid was run from a burette into a conical flask containing 25cm ³ of um hydroxide until neutralisation took place. 20cm ³ of the acid was	
	((a)	(i)	Name a suitable indicator to use in this experiment.	[1]
			(ii)	Describe the colour change that would be observed when neutralisation occurred for the indicator you named in (a) (i).	[1]
	((b)		down the chemical equation for the reaction that takes place in the II flask.	[1]
	((c)	(i) (ii)	How many moles of hydrochloric acid were used in the experiment? Using the equation in (b) , calculate the number of moles of sodium	[1]
			(")	hydroxide used.	[1]
			(iii)	Calculate the concentration of the sodium hydroxide in mol/dm ³ .	[2]
	((d)	(i)	Give a reason why the burette was used to determine the volume of the acid and not a measuring cylinder?	[1]
			(ii)	How was exactly 25cm ³ of sodium hydroxide transferred into the conical flask?	[2]
		٠		[Total: 10 mar	rks]

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Centre	Numb	ber		E	xam	inatio	n Nu	ımbe	r		

- C2 Nitrogen and argon are both elements found in air.
 - (a) Draw the electronic structures of nitrogen and argon. [2]
 - (b) With reference to the electronic structures in (a), explain why nitrogen and argon are found in Period 2 and 3 respectively. [2]
 - (c) The flowchart shows the separation of nitrogen and argon from air by fractional distillation.



- (i) Describe the processes that take place at X and Y. [3]
- (ii) Give **one** use of nitrogen gas. [1]
- (d) Argon is a liquid at -188°C.
 - (i) In what state will argon be at 5°C? [1]
 - (ii) Draw a diagram to show how the atoms of argon are arranged at 5°C. [1]

[Total: 10 marks]

[1]

[2]

C3 Ethanol is a product of many fermentation reactions. The molecular formula of ethanol is C₂H₅OH.

Draw the displayed molecular structure of ethanol.

- Charlot is C21 got 1.
- (b) When ethanol is heated with potassium dichromate (VI) it is converted to ethanoic acid.
 - (i) What type of reaction is this? [1]
 - Give one safety rule to be observed when handling ethanoic acid in the laboratory.
- (c) Ethanoic acid reacts with ethanol in the presence of a catalyst to produce a new substance. Give the name and deduce the formula of the new substance.
- (d) Ethanoic acid is a weak acid. It can react with a metal such as sodium and magnesium to liberate hydrogen gas.
 - (i) Compare the rates of reaction of ethanoic acid with sodium and with magnesium. [2]
 - (ii) What would be observed when aluminium is added to ethanoic acid?

 Give a reason for this observation. [2]
 - (iii) Give one use of aluminium based on the observation made in d (ii). [1]

[Total: 10 marks]

2 0 2 2

(a)

DATA SHEET

The Periodic Table of the Elements

Group																	
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Francium 87	R R 226	Activium 89						4									
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Key	* * *	a = relative atomic mass X = atomic symbol b = proton (atomic) number		22 E manual 80	Pa Protectinum 91	238 Unaverse	Nephrana 93		Americian 95	558	Bk Berkelun 97	Californian Si	Es Enaterism 99	Fm Fermium 100	PW 101	No N	Panencia 103
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The volume of one mole of any gas is 24 dm3 at room temperature and pressure (r.t.p.).

 $NA = 6.0 \times 10^{23}$ /mol; 1F = 96 500C.

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