ZIMSEC

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATION COUNCIL

GENERAL CERTIFICATE OF EDUCATION
ORDINARY LEVEL

QUESTION AND ANSWER BOOKLET FOR

CHEMISTRY – 4024

NOV 2013 – NOV 2019

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FOREWOOD

This is the latest series of the Zimbabwe School Examination Council Question and Answer Booklets at the Ordinary Level of the General Certificate of Education. The booklet is made up of past examination questions and suggested answers for past examinations. The council hopes that the booklet will help both teachers and learners in their preparation for examinations.

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

5071/1

CHEMISTRY

PAPER 1 Multiple Choice

NOVEMBER 2013 SESSION 1 hour

Additional materials:
- Mathematical tables and/or electronic calculator
- Multiple Choice answer sheet
- Soft clean eraser
- Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 13.

This question paper consists of 13 printed pages and 3 blank pages.

[Turn over

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General Certificate of Education Ordinary Level

CHEMISTRY

5071/1

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[Turn over

1 Which one is an example of a change of state?

A crushing limestone into powder
B warming ice in a glass tube
C concentrating ethanol solution
D sieving a mixture of sand and salt

2 Which gas has the fastest rate of diffusion?

A ammonia
B carbon dioxide
C nitrogen dioxide
D methane

3 The purity of a substance is determined by comparing experimental and theoretical values of

A solubility.
B melting point.
C weight.
D density.

4 A 45 cm^3 of water were mixed with 45 cm^3 of alcohol. The total volume was 87 cm^3.

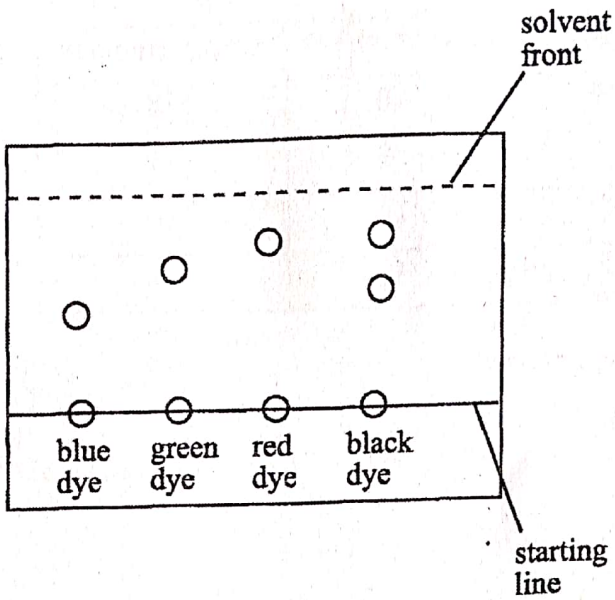
Which is the best explanation for this observation?

A some alcohol molecules evaporate
B water and alcohol react to form a gas which escapes
C alcohol molecules fit into gaps between water molecules
D water and alcohol react to produce a salt which then dissolves

5 Paper chromatography is used to separate dyes in ink because the dyes have different

A solubilities.
B viscosities.
C colours.
D volatilities.

6 The diagram shows a chromatogram obtained using solutions of four single dyes.



Which solution is impure?

A Blue only
B Green only
C Red only
D Black only

7 Which statement about graphite is correct?

A It has a tetrahedral structure.
B It has a hexagonal structure.
C It has a hard transparent structure.
D It has a square planar structure.

8 An ion with a charge of +2 and the same electronic configuration as the chloride ion is the

A phosphide ion.
B sulphide ion.
C magnesium ion.
D calcium ion.

9 The symbol of a particle with 10 electrons, 7 protons and 8 neutrons is

A Ne.
B F^-.
C O^{2-}.
D N^{3-}.

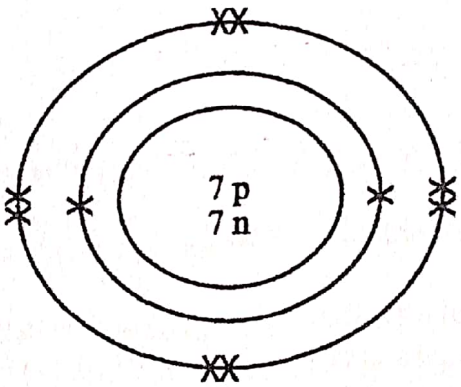
10 The table shows the mass numbers of atoms **M, N, O** and **P**.

atom	mass number	atomic number
M	40	18
N	39	19
O	40	20
P	40	19

Which atoms are isotopes?

A M and N
B N and O
C O and P
D N and P

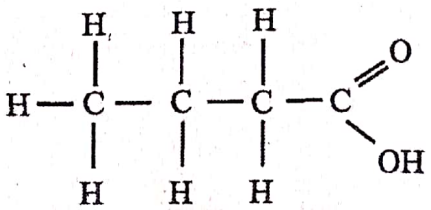
11 The diagram shows arrangement of electrons in a particle.



Which is the correct symbol for the particle?

A Ne
B O^{2-}
C N^{3-}
D N^{3+}

12 What is the empirical formula of the organic compound shown?



A CH_2O
B C_2H_4O
C $C_2H_4O_2$
D $C_4H_8O_2$

13 What is the mass of oxygen in 10 g of sodium hydroxide?

A 0.25 g
B 0.6 g
C 4.0 g
D 16 g

14 A certain quantity of the compound $Al_2(CO_3)_3$ decomposed to produce 1.32 mol of Al.

The number of moles of carbon present in the compound were

A 1.00.
B 1.32.
C 1.98.
D 3.00.

15 A chemical formula of a compound

A shows the oxidation number of elements of the compound.
B shows the exact number of atoms present in the compound.
C shows the exact relative molecules mass of the compound.
D is the same as the empirical formula of the compound.

16 What is the empirical formula of a compound which contains 64% Nitrogen and 36% oxygen by mass?

A NO
B NO_2
C N_2O
D N_2O_5

17 Which is the correct formula for ammonium sulphate?

A NH_4SO_4
B NH_3SO_4
C $(NH_4)_2SO_4$
D $(NH_3)_2SO_4$

18 A child spilled 500 cm^3 of 10 $moldm^{-3}$ HCl on a desk by mistake.

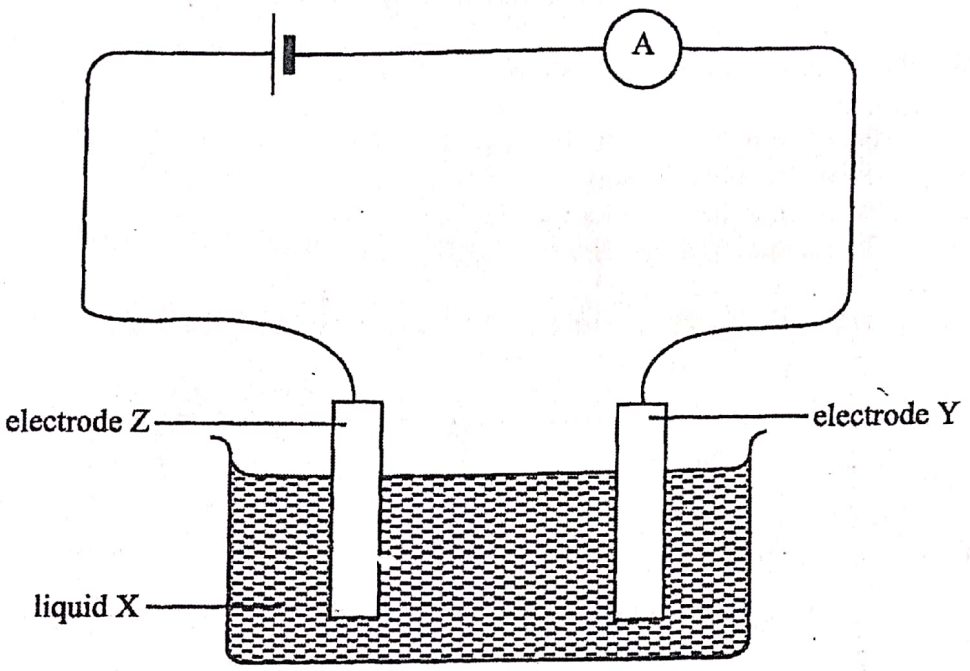
Which solution must the child use to neutralise all the acid?

A 1 000 cm^3 of 5 $moldm^{-3}$ NaOH
B 200 cm^3 of 5 $moldm^{-3}$ NaOH
C 500 cm^3 of 5 $moldm^{-3}$ NaOH
D 500 cm^3 of 1 $moldm^{-3}$ NaOH

19 What is the oxidation number of nitrogen in NO_3^-?

A +3
B +6
C +5
D − 5

20 In the circuit shown, the ammeter showed that no current was flowing.



What could be the best explanation for this observation?

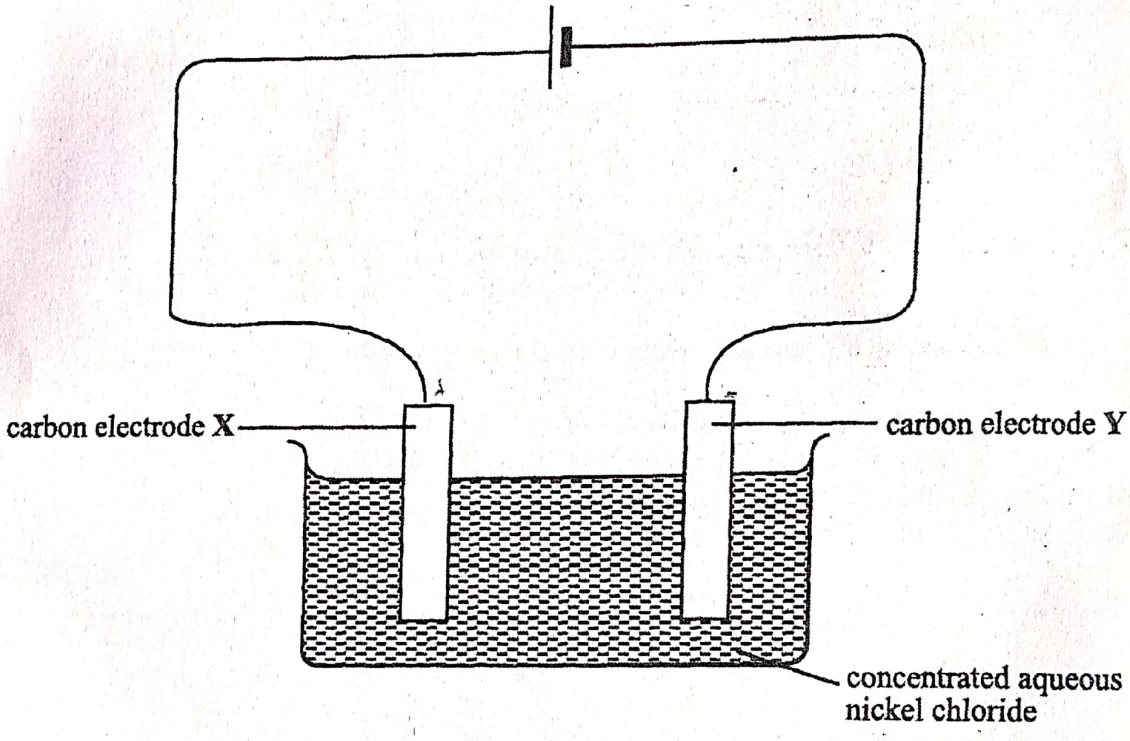
A electrodes **Y** and **Z** are made up of the same element
B electrodes **Y** and **Z** are made up different elements
C liquid **X** does not have free ions
D liquid **X** is an ionic compound

21 In an experiment $5cm^3$ of 1.0 $moldm^{-3}$ sodium hydroxide were gradually added to $10cm^3$ of 1.0 $moldm^{-3}$ hydrochloric acid containing methyl orange indicator.

Which changes occurs in the mixture?

A the mixture becomes more basic
B the mixture becomes more acidic
C the mixture becomes less acidic
D the mixture becomes neutral

22 The apparatus shows the electrolysis of concentrated nickel chloride.



What reaction occurs at X?

A oxidation of chloride ions
B reduction of chloride ions
C oxidation of nickel ions
D deposition of nickel atoms

23 The conversion of starch to a simple sugar is an example of

A condensation.
B polymerisation.
C hydrolysis
D oxidation

24 Which method can be used to obtain the elements **P** and **Q** from the ionic compound **PQ**?

A distillation
B electrolysis
C precipitation
D crystallisation

25 In which reaction is hydrogen acting as an oxidising agent?

A $H_2 + CuO \rightarrow H_2O + Cu$

B $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

C $H^+ + OH^- \rightarrow H_2O$

D $N_2 + 3H_2 \rightarrow 2NH_3$

26 The reaction between magnesium oxide and nitric acid is an example of

A oxidation reaction.
B reduction reaction.
C displacement reaction.
D neutralisation reaction.

27 Which ion forms a green precipitate with ammonia solution?

A Al^{3+}
B Cu^{2+}
C Fe^{2+}
D Fe^{3+}

28 Element **Y** reacts with water producing an acidic solution which gives a white precipitate with aqueous silver nitrate.

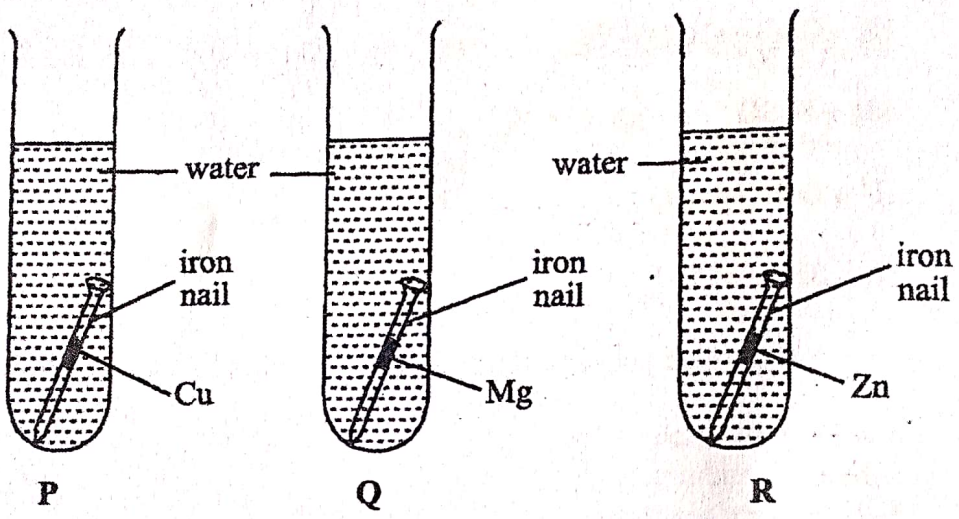
In which group of the Periodic Table is element **Y**?

A V
B VI
C VII
D VIII

29 Which metal has the **least** tendency to form positive ions?

A potassium
B zinc
C lead
D iron

30 The experiments shown were set up to compare effect of sacrificial protection by different metals.



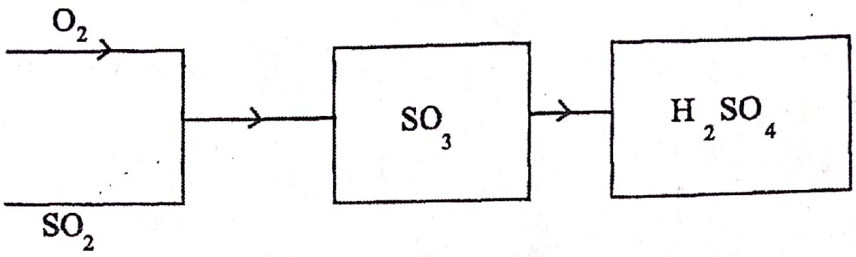
In which tube(s) will the iron rust?

A Q only
B P only
C R only
D all three

31 When crystals of copper (II) sulphate are gently heated, the colour changes from blue to white because of

A loss of water only.
B loss of water and sulphur (IV) oxide.
C loss of water, sulphur dioxide and oxygen.
D reaction with water vapour in the air.

32 Sulphuric acid is produced by the process.



What is used in the industrial conversion of SO_3 to H_2SO_4?

A water only
B sulphuric acid only
C water followed by conc sulphuric acid
D conc sulphuric acid followed by water

33 What process is used to extract silicon from silica?

A electrolysis
B hydrolysis
C reduction
D precipitation

34 What is the chemical formula for limestone?

A CaO
B $Ca(OH)_2$
C $CaCO_3$
D $CaHCO_3$

35 During fermentation of glucose to ethanol, air should not enter the fermenting mixture because

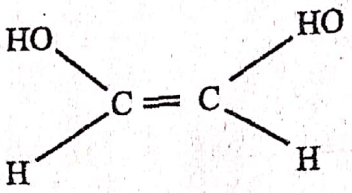
A ethanol will evaporate.
B ethanoic acid will be formed.
C zymase enzymes will be denatured.
D glucose will be oxidised to carbon dioxide and water.

36 Which reaction **does not** produce a gas?

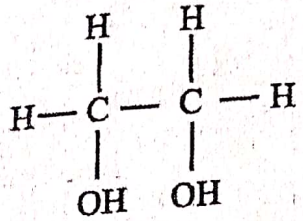
A adding dilute HC*l* to silver
B adding dilute HC*l* to copper
C adding dilute HC*l* to lead
D adding dilute HC*l* to calcium

[Turn over

37 The diagrams show the structures of compounds **S** and **T**.



S



T

Which substance can be used to distinguish between **S** and **T**?

A oxygen
B bromine
C hydrogen
D chlorine

38 Ethene reacts with steam to form

A ethane.
B ethanoic acid.
C ethanol.
D polyethene.

39 Which equation represents the complete combustion of C_3H_7OH?

A $2C_3H_7OH + 3O_2 \rightarrow 6C + 8H_2O$

B $2C3H_7OH + 5O_2 \rightarrow 6CO_2 + 8H_2$

C $2C_3H_7OH + 6O_2 \rightarrow 6CO + 8H_2O$

D $2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$

40 Polyethene can form carbon dioxide and water by the process of

A condensation.
B combustion.
C fermentation.
D reduction.

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group O
									1 H Hydrogen 1								4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Ordinary Level

EXPECTED ANSWERS

CHEMISTRY	NOV 2013	5071/1

1	B
2	D
3	B
4	C
5	A
6	D
7	B
8	D
9	D
10	D
11	C
12	B
13	C
14	C
15	B
16	C
17	C
18	A
19	C
20	C

21	C
22	A
23	C
24	B
25	B
26	D
27	C
28	C
29	C
30	B
31	A
32	D
33	C
34	C
35	D
36	B
37	B
38	C
39	D
40	B

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/2

PAPER 2 Theory

NOVEMBER 2013 SESSION 1 hour 30 minutes

Additional materials:
Answer paper
Mathematical tables and/or 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 and on all separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.

Write your answers on the separate answer paper provided

At the end of the examination, fasten any separate answer paper used securely to the question paper.

Enter the numbers of **Section B** questions you have answered in the grid.

All essential working must be shown.

INFORMATION FOR CANDIDATES

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

A copy of the Periodic Table is printed on page 13.

FOR EXAMINER'S USE	
Section A	
Section B	
TOTAL	

This paper consists of 13 printed pages and 3 blank pages.

[Turn over

Section A

*Answer **all** the questions in the spaces provided.*

The total mark for this section is 45.

1 **Fig. 1** shows structures of some atoms and ions.

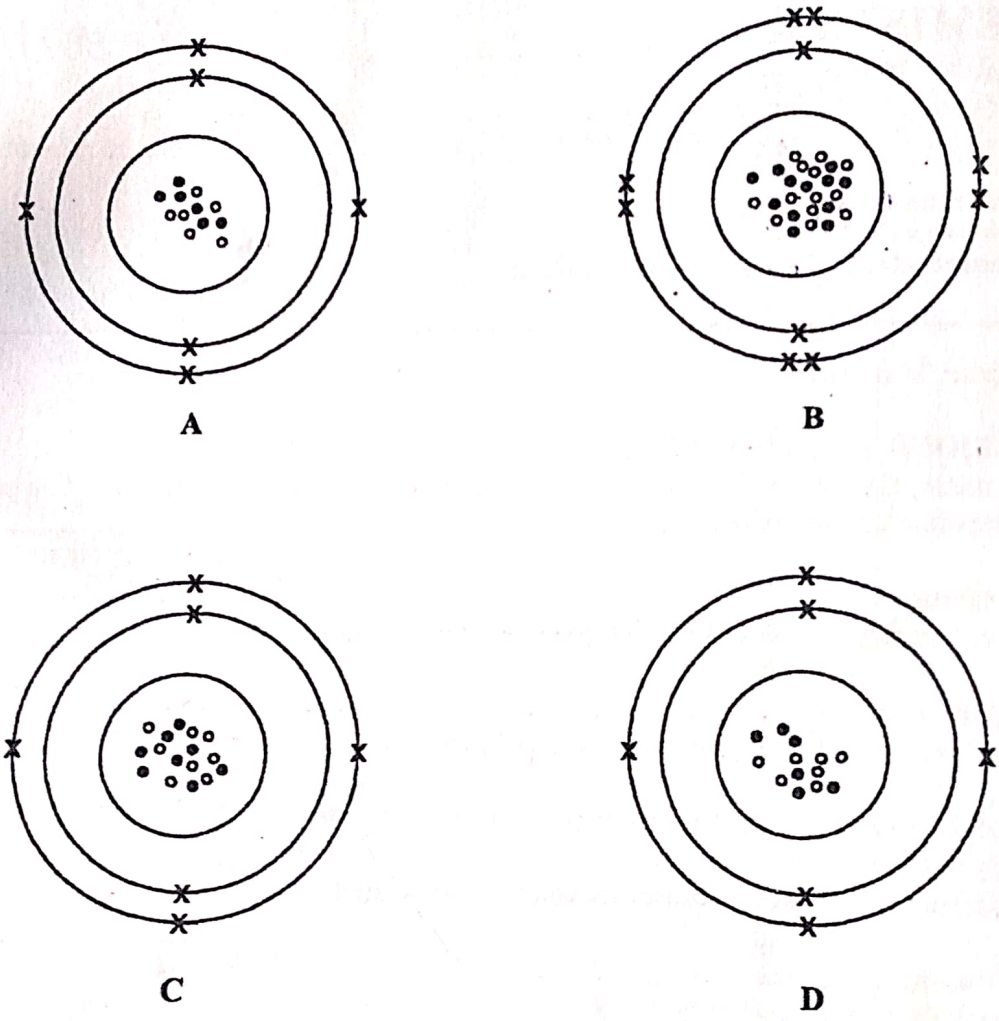


Fig. 1

(a) Name the particles represented by these symbols ∘ and ●.

(i) ∘, _____

(ii) ●. _____ [2]

For Examiner's Use

(b) Identify the structure that represents an isotope in **Fig. 1.**

_____ [1]

(c) Which particle is

(i) a cation, _____

(ii) an anion. _____ [2]

(d) (i) Draw a dot and cross-diagram to show bonding between **A** and hydrogen.

[2]

(ii) Name the compound formed in **(i)**

_____ [1]

(iii) State any two physical properties of the compound named in **(ii)**.

1._____

2._____ [2]

[Total: 10]

2 Oxides are classified as acidic, basic and amphoteric.

(a) Give one example of each type of oxide using elements in Period 3 of the Periodic Table.

(i) acidic oxide, _____

basic oxide, _____

amphoteric oxide. _____ [3]

(ii) Write equations for the reactions of the amphoteric oxide named in **(i)** with

1. HCl _____

2. NaOH _____ [2]

(b) **Fig. 2** shows a pH scale.

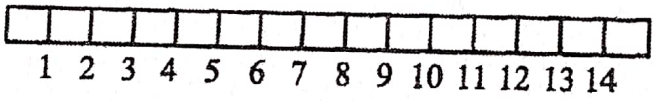


Fig. 2

On the pH scale indicate, by means of a line the pH range of

1. lemon juice,

2. toothpaste.

[2]

(c) **Table 1** is a record of industrial gases used in some manufacturing processes, their uses and how they can be identified.

For Examiner's Use

Complete **Table 1.**

Table 1

name of gas	**method of manufacture**	**use of gas**	**identification of gas**
oxygen		steel making	
			turns lime water milky
	electrolysis of water	manufacture of ammonia	

[7]

[Total: 14]

3 The reaction scheme in **Fig. 3** shows some of the reactions of copper and its compounds.

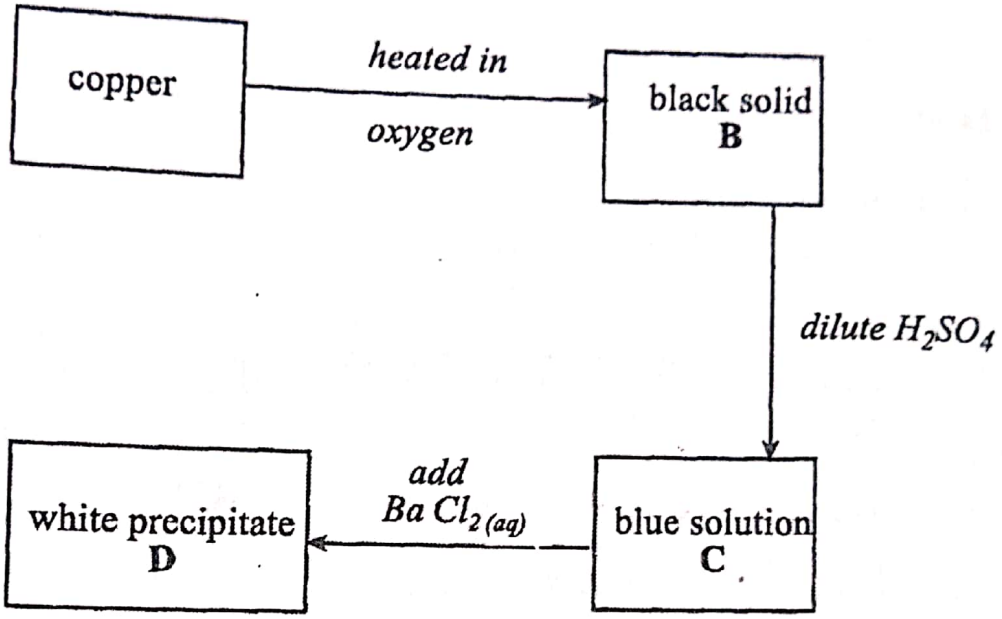


Fig. 3

(a) **(i)** Name the

1. black solid **B**, _____

2. blue solution **C**, _____

3. white precipitate **D**. _____ [3]

(ii) Write the equation of a reaction between magnesium and the black solid **B**.

_____ [1]

(iii) Name the type of reaction in (ii)

_____ [1]

(b) Given that 2.4 g of magnesium were required to react with all the black solid **B**, calculate the mass of **B** that reacted.

[3]

(c) Write the ionic equation for the formation of the white precipitate **D** including state symbols.

[2]

[Total: 10]

4 **Fig. 4** shows the general set up of apparatus for carrying out electrolysis in a school laboratory.

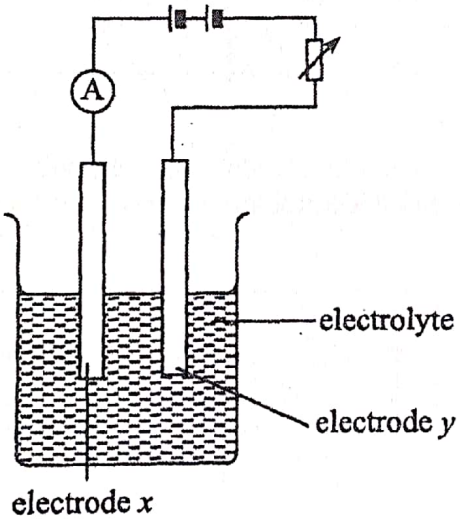


Fig. 4

(a) Complete **Table 2.**

Table 2

electrolyte	electrode *x*	electrode *y*	reaction at cathode	reaction at anode
molten lead (II) bromide	graphite	graphite		
			$4OH^- \rightarrow O_2 + 2H_2O + 4e^-$	$Cu^{2+} + 2e^- \rightarrow Cu$
	copper	copper	$Cu \rightarrow Cu^{2+} + 2e^-$	

[7]

(ii) State **one** observation made during the electrolysis of molten lead (II) bromide.

_____ [1]

(b) Draw a labelled diagram of the set up of apparatus for copper-plating a spoon.

[3]
[Total: 11]

Section B

*Answer any **three** questions from this section.*

5 **(a)** State

(i) **two** different physical properties of bromine and iodine,

(ii) **two** similar chemical properties of bromine and iodine.

(iii) any **two** uses of chlorine. [6]

(b) Chlorine reacts with potassium bromide as shown.

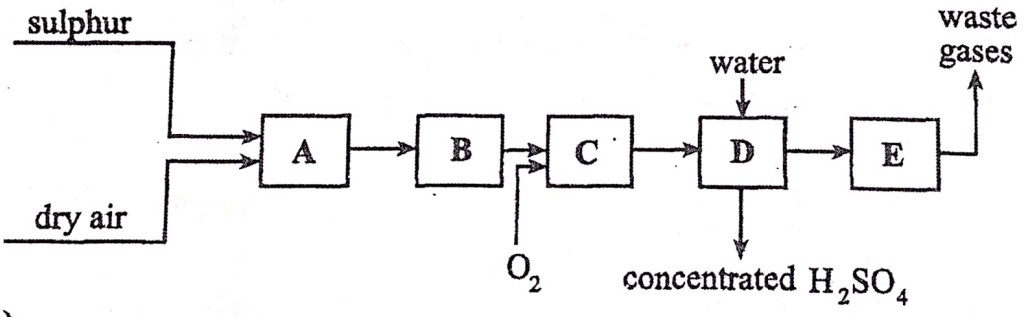
$$2KBr_{(aq)} + Cl_{2(g)} \rightarrow 2KCl_{(aq)} + Br_{2(g)}$$

(i) State **one** observation made as the reaction occurs.

(ii) Name this type of reaction giving a reason for your answer.

[4]
[Total: 10]

6 **Fig.5** shows the main steps in the manufacture of sulphuric acid.



(a)

Fig. 5

(i) Choose from the letters A – E, the box that would be labelled

1. catalytic converter,
2. chimney,
3. purifier.

(ii) Identify **one** error on the flow diagram and describe how this can be corrected.

(iii) State any **one** condition used in **C** and write the overall equation for the reaction which takes place.

[7]

(b) Describe how sulphuric acid is converted into ammonium sulphate fertilizer.

[3]

[Total: 10]

7 **Fig. 6** shows how ethene can be prepared from paraffin of the formula $C_{12}H_{26}$.

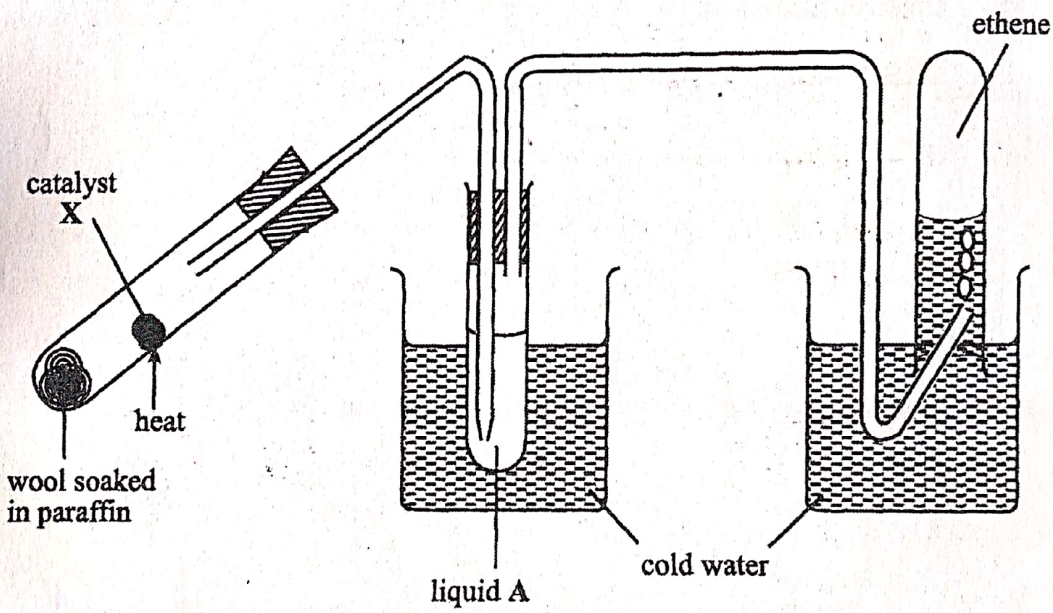


Fig. 6

(a) (i) Name

1. the process shown in **Fig. 6**

2. catalyst **X**.

(ii) Give the molecular formula of liquid **A** and hence write the equation for the formation of liquid **A** and ethene.

(iii) Describe the observation made when bromine is added to ethene and write the equation for the reaction which takes place.

[6]

(b) (i) Define the term homologous series.

(ii) State the homologous series to which paraffin belongs.

(iii) Draw the structures of two isomers of an organic compound that contains four carbons and is in the same homologous series as paraffin.

[4]

[Total: 10]

8 (a) **Fig. 7** shows how a gas, Y, can be produced from ethanol.

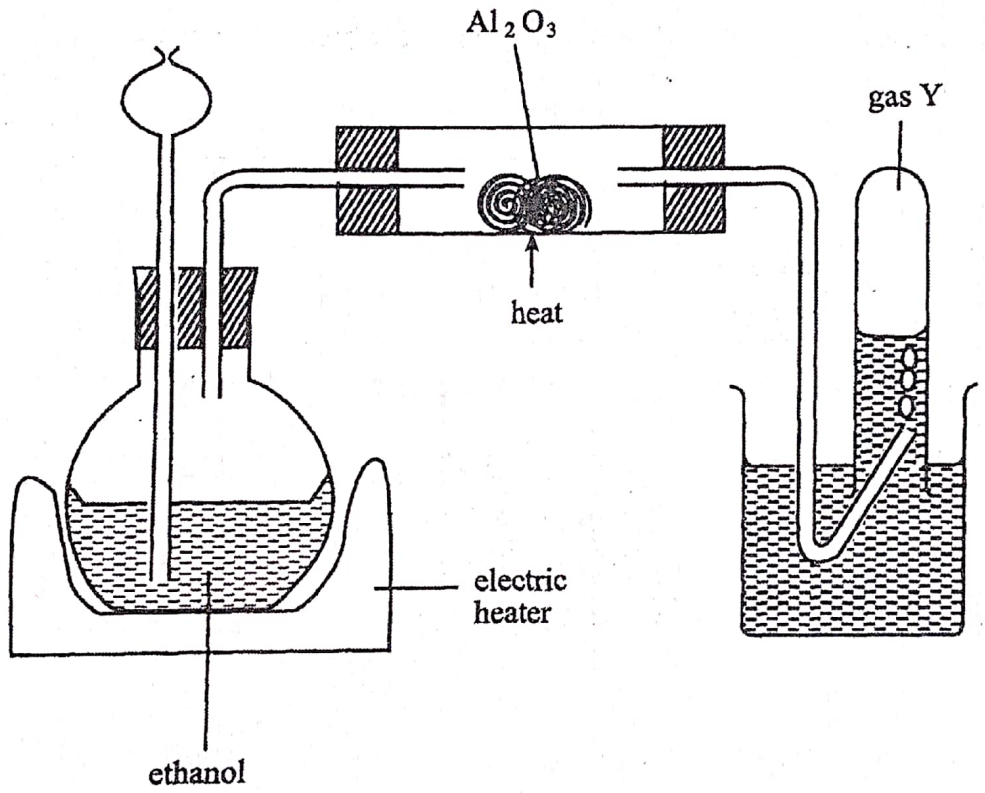


Fig. 7

(i) Name gas Y.

(ii) Write an equation for the reaction that takes place during the production of gas Y.

(iii) Explain why an electric heater is used to heat the ethanol.

[3]

(b) **(i)** Write an equation for the combustion of ethanol.

(ii) On combustion, 46 g of ethanol gives out 1 380 kJ of energy.

If 0.5 moles of ethanol were burnt at r.t.p, calculate

1. the energy produced,

2. the volume of carbon dioxide produced.

(iii) Explain why ethanol is used as a fuel in lamps

[7]

[Total: 10]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group O
											1 H Hydrogen 1						4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

5071/2 N2013

ZIMBABWE SCHOOL EXAMINATION COUNCIL

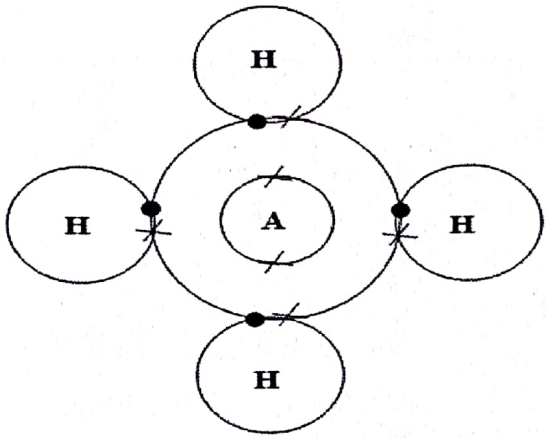
General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2013

CHEMISTRY

4024/2

1	(a)	(i)	Protons
		(ii)	Neutrons
	(b)		A and D
	(c)	(i)	B
		(ii)	C
	(d)	(i)	
		(ii)	Methane
		(iii)	Low boiling Point Insoluble in water Poor electrical conductivity
2	(a)	(i)	Acidic Oxide - $SiO_2/P_4O_6/P_4O_{10}/SO_2/SO_3$
			Basic Oxide - Na_2O/MgO
			Amphoteric Oxide-Al_2O_3
		(ii)	$Al_2O_{3(s)} + 6HCl_{(aq)} \rightarrow 2AlCl_{3(aq)} +$
		(iii)	$Al_2O_{3(s)} + 3H_2O_{(l)} + 2NaOH_{(aq)} \rightarrow 2Na[Al(OH)_{4(aq)}$
	(b)		1. Lemon Juice – PH 3-6 2. ToothPaste – 8-10

(c)

Name of gas	Method of Manufacture	Use	Identification of gas
	• Fractional Distillation of liquid air • Electrolysis of Water		• Relights a glowing splint
Carbon Dioxide	• Fermentation • Separation of air	• Fire extinguisher • Dry air • Carbonated drinks	
Hydrogen			Burns with a pop sound

3 **(a)** **(i)** Copper (II) Oxide/CuO

Copper (II) Sulphate / $CuSO_4$

Barium Sulphate

(ii) $Mg + CuO \rightarrow MgO + Cu$

(iii) Redox/Reduction – Oxidation/Displacement

(b) $\frac{2{,}4g}{M_r(Mg)} = 0.1\ moles\ of\ Mg$

$1:1\ reaction \rightarrow 0.1\ moles\ of\ CuO\ present$

$Mass = M_r(CuO) \times 0.1 moles\ CuO\ present$

$= 80 \times 0.1$

$= \mathbf{8g}$

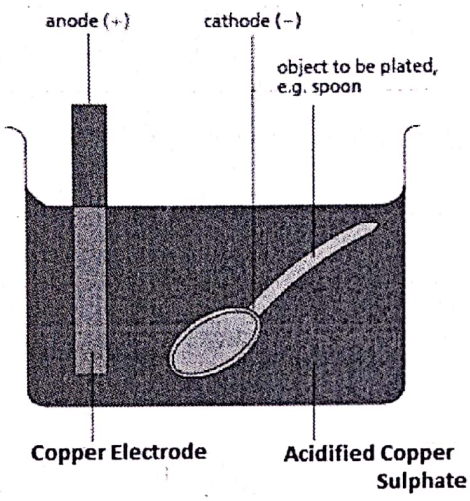
(c) $Ba^{2+}{}_{(aq)} + SO^{2-}{}_{4(aq)} \rightarrow BaSO_{4(s)}$

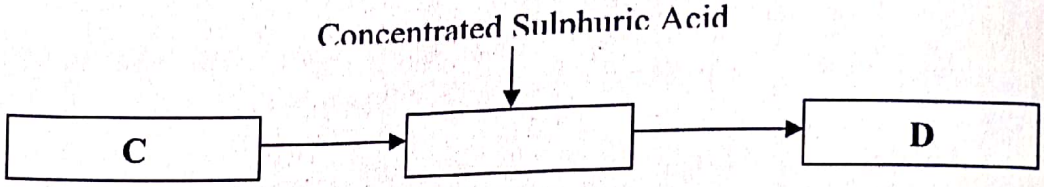
4 **(a)** **(i)** Cathode $Pb^{2+} + 2e^- \rightarrow Pb$

Anode $2Br^- \rightarrow Br_2 + 2e^-$

Electrolyte $CuSO_{4(aq)}$

Electrode X: Graphite/Carbon

	(b)		Electrode Y: Graphite/Carbon Electrolyte $CuSO_{4(aq)}$ Anode $Cu_{(s)} \rightarrow Cu^{2+} + 2e^-$
		(ii)	Red brown vapour produced at anode
			
5	(a)	(i)	Bromine is a liquid whereas iodine is a solid Bromine has red-brown colour, iodine is black
		(ii)	-Seven electrons in the outer shell -good oxidising agents -react by accepting/sharing electrons
		(iii)	-Purification of water -Manufacture of plastics/pvc
	(b)	(i)	-Bubbles of gas -The solution turns from colourless to red brown
		(ii)	Redox/displacement Reason: There is a change in oxidation numbers
6	(a)	(i)	**1.** C **2.** E **3.** B
		(ii)	Absorption stage missing between C and D



(iii) 1 atmosphere pressure
450°C tempereture
Vanadium Pentoxide catalyst

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

(b) React sulphuric acid with ammonia
Evaporate the solution
Crystallize the solution

7 (a) (i) **1.** Cracking

2. Aluminium Oxide/Silicon Dioxide

(ii) $C_{10}H_{22}$

$C_{12}H_{26} \rightarrow C_{10}H_{22} + C_2H_4$

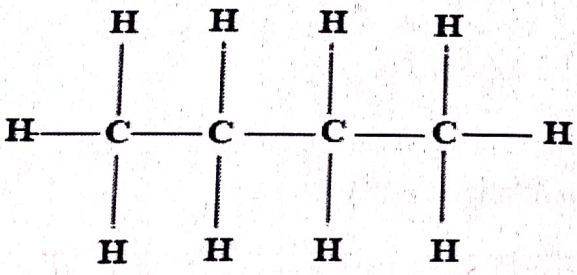
(iii) Bromine is decolourised

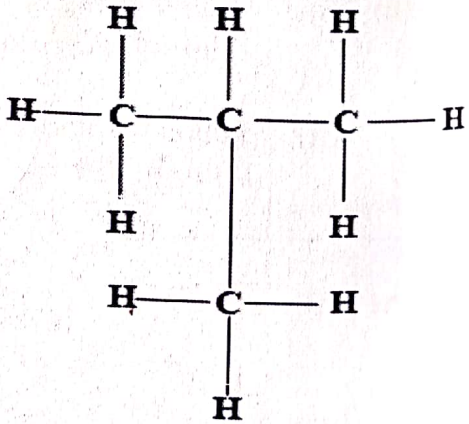
$C_2H_4 \rightarrow CH_2BrCH_2Br$

(b) (i) A group of organic compounds with the same general formula and similar chemical properties

(ii) Alkanes

(iii)





8	(a)	(i)	Ethene
		(ii)	$CH_3CH_2OH \xrightarrow[Catalyst]{Al_2O_3} CH_2CH_2+H_2O$
		(iii)	Ethanol is highly flammable and should not be heated with a naked flame
	(b)	(i)	$CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
		(ii)	$46g\ ethanol = 1\ mole$ $Energy\ produced\ by\ 0.5moles\ =\ 0.5moles = 0.5 \times 1\,380Kj$ $= \mathbf{690Kj}$ $moles\ CO_2\ =\ 2 \times moles\ of\ ethanol$ $=\ 2 \times 0.1$ $=\ 1\ mol$ $Vol\ CO_2\ =\ number\ of\ moles \times molar\ gas\ vol$ $= 1 \times 28\ dm^3$ $= \mathbf{28\ dm^3}$
		(iii)	Ethanol produces a lot of heat energy on combustion

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

PAPER 1 Multiple Choice

5071/1

NOVEMBER 2014 SESSION

1 hour

Additional materials:
- Mathematical tables and/or electronic calculator
- Multiple Choice answer sheet
- Soft clean eraser
- Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D.** Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

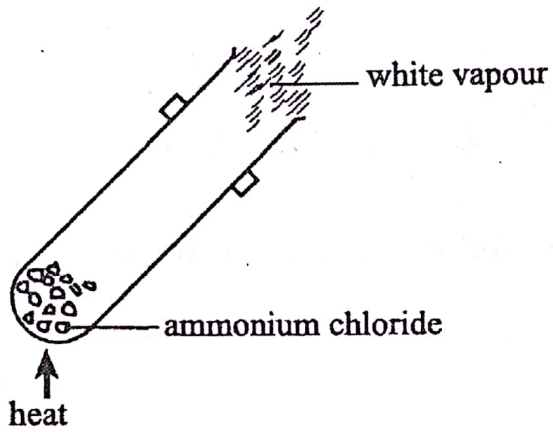
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 15.

This question paper consists of 15 printed pages and 1 blank page.

1 Which is the best way to test for the purity of propanoic acid?

A react it with ethanol
B measure its boiling point
C burn it completely in oxygen
D measure its pH

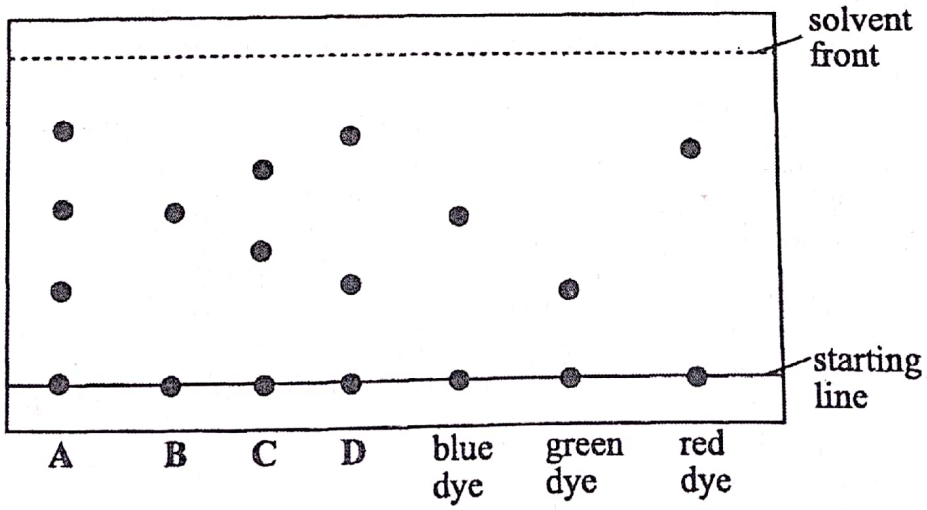
2 The diagram shows ammonium chloride being heated.



Which process is taking place?

A evaporation
B condensation
C distillation
D sublimation

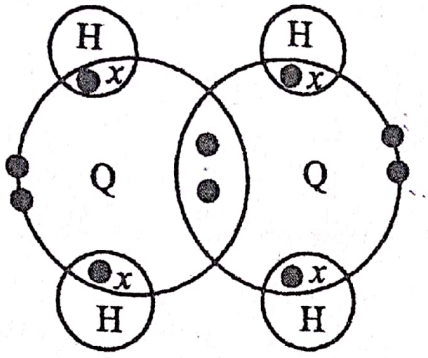
3 The diagram shows a chromatogram obtained using solutions of three single dyes (blue, green and red) and four other solutions (A, B, C and D).



Which of the solutions A, B, C or D contains a dye other than blue, green and red?

4 The diagram shows bonding between element Q and hydrogen. Only outer most electrons are shown.

Key ● = Q electrons
x = H electrons



To which group of the Periodic Table does element Q belong?

A 4
B 5
C 6
D 8

5 In which set do all ions have the same total number of electrons?

A F^-, Mg^{2+}, Na^+
B Li^+, Na^+, K^+
C Be^{2+}, Mg^{2+}, Ca^{2+}
D S^{2-}, O^{2-}, Cl^-

6 The elements U, V and W have consecutive increasing atomic numbers.

If element U is a noble gas, what will be the symbol for the ion of the element W in its compounds?

A W^-
B W^{2-}
C W^+
D W^{2+}

7 An element X has a proton number of 3. Which statement about X is correct?

A It is in Group (III) of the periodic table.
B It forms the chloride XCl_3.
C It forms ions by gaining electrons.
D If forms the chloride XCl.

8 How many moles of oxygen molecules are required to oxidise four moles of sulphur dioxide to sulphur trioxide?

A 1.0
B 2.0
C 3.0
D 4.0

9 Which hydrocarbon contains 80% by mass of carbon?

A C_2H_4
B C_2H_6
C C_3H_6
D C_4H_{10}

10 A solution containing 0.1 moles XSO_4 combines with 5.4 g of water to form the hydrate $XSO_4.nH_2O$.

What is the value of n?

A 1
B 2
C 3
D 4

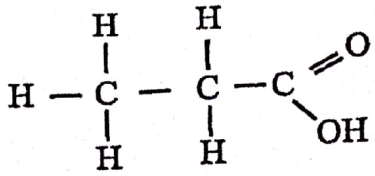
11 Zinc sulphide ($M_r = 97$) when heated in air reacts as shown

$ZnS + 2O_2 \rightarrow ZnO + SO_3$.

What volume of oxygen, at r.t.p., would react completely with 194 g of ZnS?

A 4 dm^3
B 67.2 dm^3
C 72 dm^3
D 112 dm^3

12 What is the % of carbon in the compound shown?



A 32.1
B 36.0
C 48.6
D 62.0

13 An organic compound of M_r 60 contains 6 g carbon, 1 g hydrogen and 8 g oxygen.

What is the molecular formula of the compound?

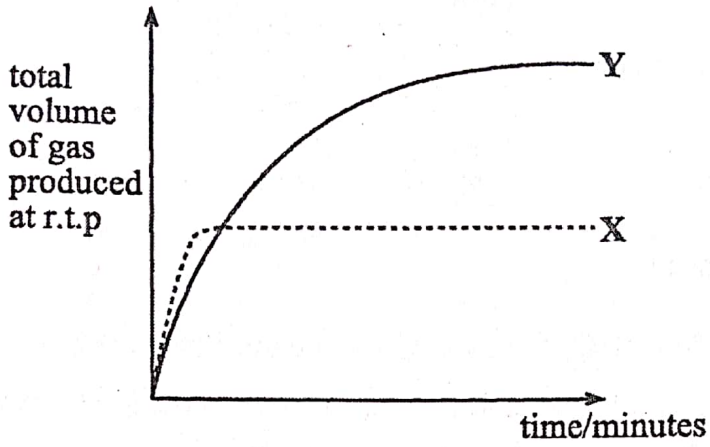
A CH_2O
B C_3H_2O
C $C_2H_4O_2$
D C_2H_6O

14 What is observed at the anode during electrolysis of copper (II) sulphate solution using copper electrodes.

A copper thickens
B copper dissolves
C gas bubbles
D blue colour fades

[Turn over

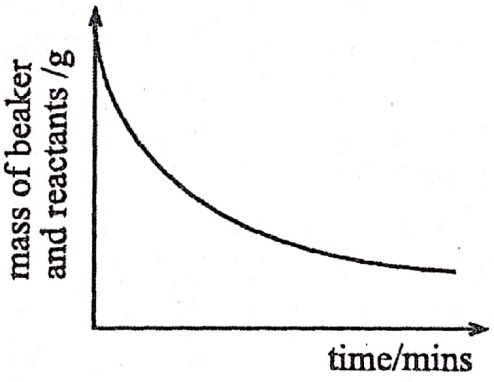
15 In the graph, curve Y represents the result of the reaction between 2.0 g of granulated zinc and an excess of acid at 30°C.



Which change could produce curve X?

A 2.0 g powdered zinc at 20°C
B 2.0 g granulated zinc at 40°C
C 1.0 g granulated zinc at 20°C
D 1.0 g granulated zinc at 40°C

16 Two reactants were mixed in a beaker, the mass of the beaker and contents was then recorded at various times. The graph shows the results.



Which pair of reactants produced this graph?

A aqueous copper (II) sulphate and dilute nitric acid
B aqueous sodium carbonate and dilute nitric acid
C aqueous sodium hydroxide and aqueous zinc sulphate
D dilute hydrochloric acid and aqueous sodium sulphate

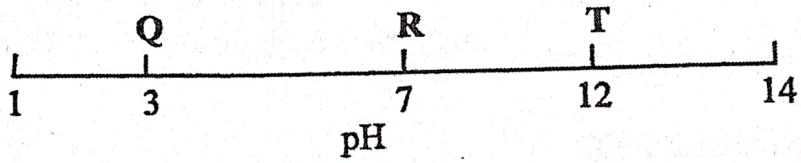
17 Magnesium and copper sulphate reacts as shown.

$$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$$

Which **one** is the oxidising agent?

A copper
B copper sulphate
C magnesium
D magnesium sulphate

18 The pH values of three liquids **Q**, **R** and **T** of equal concentration are shown in the diagram.



What could the aqueous solutions be?

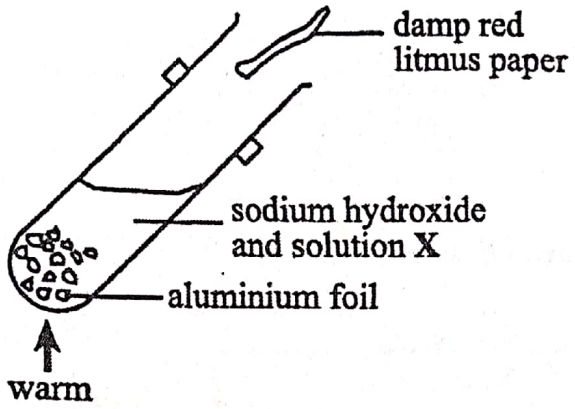
	Q	R	T
A	ethanoic acid	potassium chloride	sodium hydroxide
B	potassium chloride	ethanoic acid	sodium hydroxide
C	sodium hydroxide	ethanoic acid	potassium chloride
D	ethanoic acid	water	potassium chloride

19 Which compound gives a white precipitate with aqueous silver nitrate and a pale blue precipitate with aqueous sodium hydroxide?

A copper chloride
B copper hydroxide
C copper sulphate
D silver sulphate

[Turn over

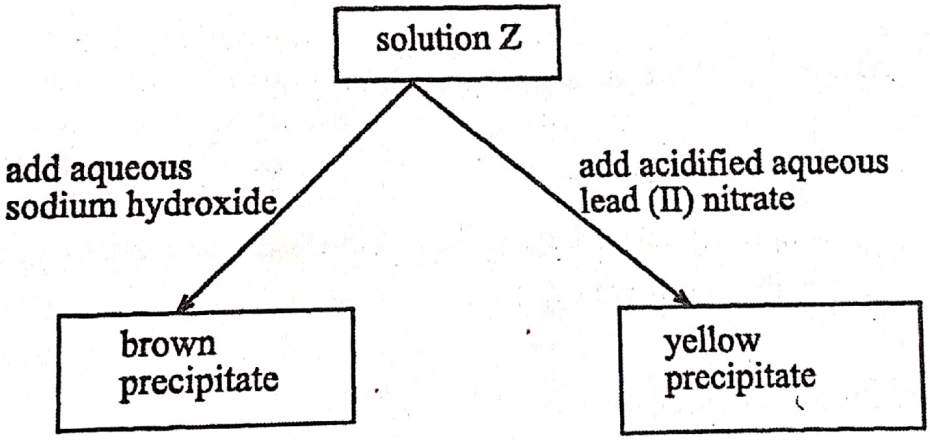
The apparatus shown was used to detect an ion present in solution **X**.



Which ion was present in solution **X** if the damp litmus paper turned blue?

A NH_4^+
B CO_3^{2-}
C NO_3^-
D SO_4^{2-}

The following observations were made on solution Z.



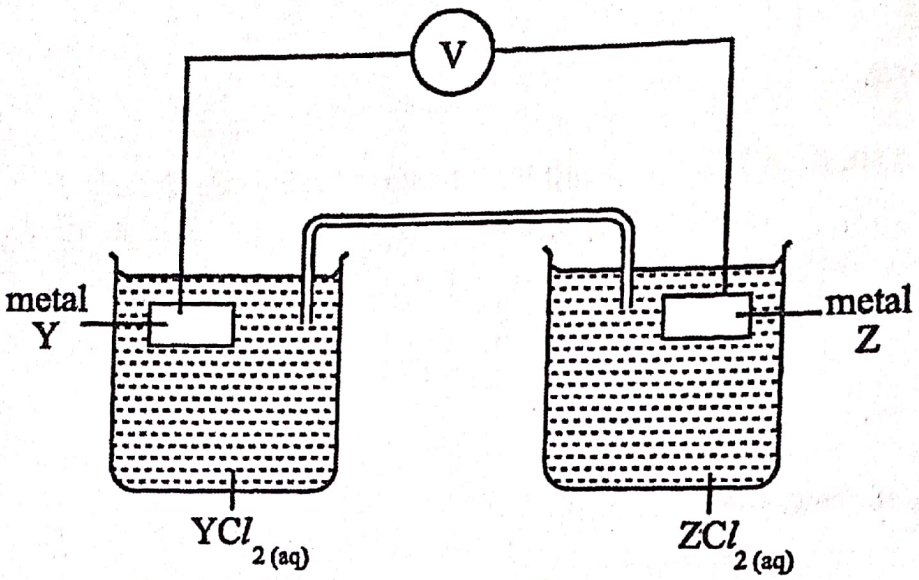
Ions present in Z are

A Fe^{2+} and I^-
B Fe^{2+} and Cl^-
C Fe^{3+} and I^-
D Fe^{3+} and Cl^-

22 Which element reacts with cold water to form a soluble compound and an insoluble gas?

A magnesium
B zinc
C potassium
D aluminium

23 A voltage is produced by the apparatus shown.



Which pair of metals Y and Z will produce the largest voltage?

	Y	Z
A	iron	copper
B	magnesium	copper
C	zinc	copper
D	zinc	iron

24 An element Q reacts in the following ways.

(i) $2Q + O_2 \rightarrow 2QO$
(ii) $Q + 2HCl \rightarrow QCl_2 + H_2$
(iii) $QO + H_2 \rightarrow$ no reaction

Which element is Q?

A calcium
B copper
C lead
D silver

25 Which substance **cannot** reduce iron (III) oxide to iron?

A coke
B carbon monoxide
C carbon dioxide
D magnesium

26 Which catalyst is used during hydrogenation?

A rodium/platinum
B nickel
C vanadium (V) oxide
D Iron

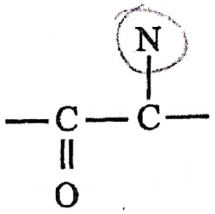
27 Which gas is the main cause of damage to buildings?

A CO_2
B CO
C CH_4
D SO_2

28 The reaction between an alkene and bromine is

A an addition reaction
B a substitution reaction
C a condensation reaction
D a reduction reaction

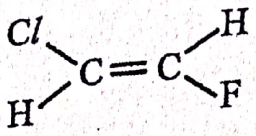
29 Which substances contain the amide linkage shown?



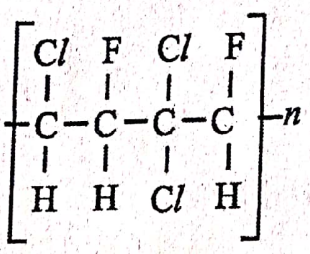
amide linkage

A nylon and terylene
B nylon and protein
C sugars and protein
D terylene and sugar

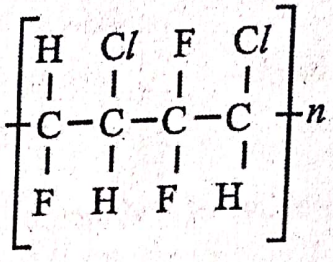
30 The diagram shows the structure of a monomer.



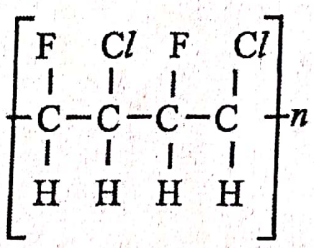
Which polymer can be made from this monomer?



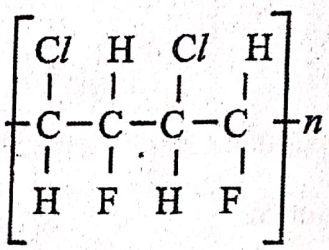
A



B

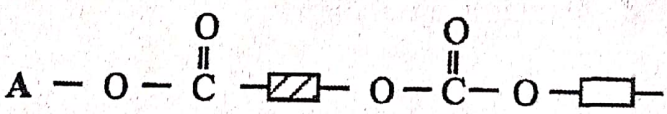


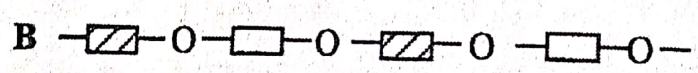
C

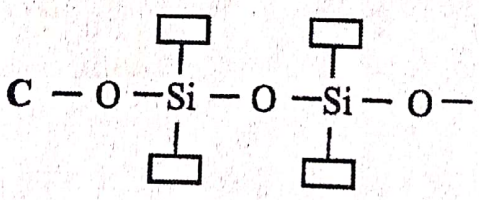


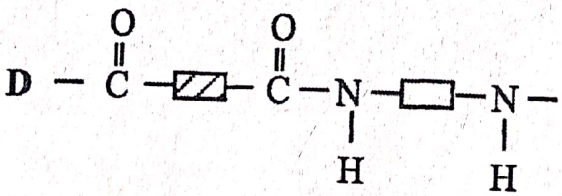
D

31 Which diagram shows the structure of a fire resistant polymer?









[Turn over

32 The equation shows the cracking of the molecule $C_{20}H_{42}$

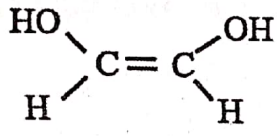
$$C_{20}H_{42} \rightarrow C_{12}H_{26} + X$$

What is X?

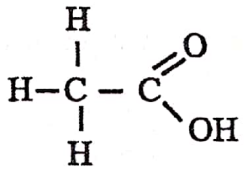
A C_8H_{12}
B C_8H_{14}
C C_8H_{16}
D C_8H_{18}

33 A compound of molecular formula $C_2H_4O_2$ reacts with ethanol in the presence of concentrated sulphuric acid to form an ester.

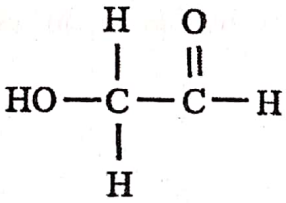
What is the structural formula of the compound?



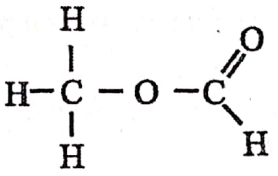
A



B



C



D

34 Which test is used to identify an unsaturated hydrocarbon?

A burn in air to form carbon dioxide and water
B react with hydrogen to form a solid
C shake with ethanol to give a white emulsion
D react with bromine water to decolourise it

35 The general formula of an alkane of M_r 58 is C_nH_{2n+2}.

What is the value of n?

A 2
B 3
C 4
D 5

36 Which material **cannot** be used as an energy source for a power station?

A coal
B nitrogen
C hydrogen
D methane

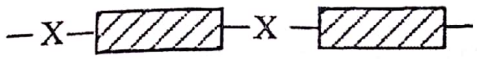
37 Ethanol is used in perfumes. Which property makes it suitable for this use?

A It has a characteristic smell.
B It is colourless.
C It vapourises easily.
D It dissolves in water.

38 Which one is an ester?

A P.V.C.
B nylon
C starch
D terylene

39 Starch can be represented as



What is **X**?

A carbon
B hydrogen
C nitrogen
D oxygen

40 The taste of wine changes after contact with air because some of the ethanol in wine

A evaporates quickly.
B ferments slowly.
C reacts with carbon dioxide.
D reacts with oxygen.

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Ordinary Level

EXPECTED ANSWERS

CHEMISTRY	NOV 2014	5071/1

1	B
2	D
3	A
4	A
5	A
6	B
7	B
8	B
9	B
10	C
11	D
12	C
13	C
14	B
15	A
16	D
17	B
18	A
19	B
20	A

21	C
22	C
23	B
24	A
25	C
26	B
27	D
28	B
29	B
30	D
31	D
32	C
33	B
34	D
35	C
36	B
37	C
38	D
39	D
40	D

Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/2

PAPER 2 Theory

NOVEMBER 2014 SESSION 1 hour 30 minutes

Additional materials:
Answer paper
Mathematical tables and/or 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 and on all separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **three** questions.

Write your answers on the separate answer paper provided

At the end of the examination, fasten any separate answer paper used securely to the question paper.

Enter the numbers of **Section B** questions you have answered in the grid.

All essential working must be shown.

INFORMATION FOR CANDIDATES

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

A copy of the Periodic Table is printed on page 15.

FOR EXAMINER'S USE	
Section A	
Section B	
TOTAL	

This paper consists of 15 printed pages and 1 blank page.

[Turn over

Section A

Answer all the questions in the spaces provided.

1 (a) Give the name and number of subatomic particles contained in chlorine - 35, ^{35}Cl.

name of particle	number
_____	_____
_____	_____
_____	_____ [3]

(b) State any one difference between a chlorine atom and a chloride ion.

_____

_____

_____ [1]

(c) (i) Draw dot-and-cross diagrams to illustrate bonding in

1. carbon tetrachloride,

[2]

For Examiner's Use

2. calcium chloride.

[2]

(ii) Explain why

1. carbon tetrachloride is a liquid while calcium chloride is a solid at room temperature,

_____

_____

_____

_____ [1]

2. carbon tetrachloride does not conduct electricity in any form while calcium chloride conducts in solution and molten forms.

_____

_____

_____

_____ [1]

[Total: 10]

2 (a) Listed are some types of chemical reactions:

neutralisation; redox; elimination;
hydrolysis; dehydration; decomposition and precipitation

For each of the reactions, choose from the list the type of reaction it is.

	Reaction	Type
(i)	$AgNO_3 + KI \rightarrow AgI + KNO_3$	_____
(ii)	$Cl_2 + 2NaBr \rightarrow Br_2 + 2NaCl$	_____
(iii)	$MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$	_____
(iv)	$CH_3CO_2C_2H_5 + H_2O \rightarrow CH_3CO_2H + C_2H_5OH$	_____

[4]

(b) When potassium chlorate (V), $KClO_3$ is heated strongly, it breaks down to potassium chloride and oxygen only.

(i) State what (V) in potassium chlorate (V) stands for.

_____

_____ [1]

(ii) Construct an equation for the reaction described.

_____ [1]

(iii) Use your equation to deduce the volume of oxygen at r.t.p that can be produced by the complete break down of 10 g of $KClO_3$.

volume of oxygen = _____ [3]

[Total: 9]

For Examiner's Use

3 In an experiment to investigate the rate of reaction between iron filings and sulphuric acid, 100 cm^3 of 0.2 $moldm^{-3}$ sulphuric acid was added to 5.0 g of iron filings. The gas produced was collected and measured at regular intervals of time.

The results obtained were as shown in **Table 1.**

Table 1

time/min	0	30	60	90	120	150	180
volume of gas/cm^3	0.00	12.00	24.67	36.67	43.99	48.00	48.00

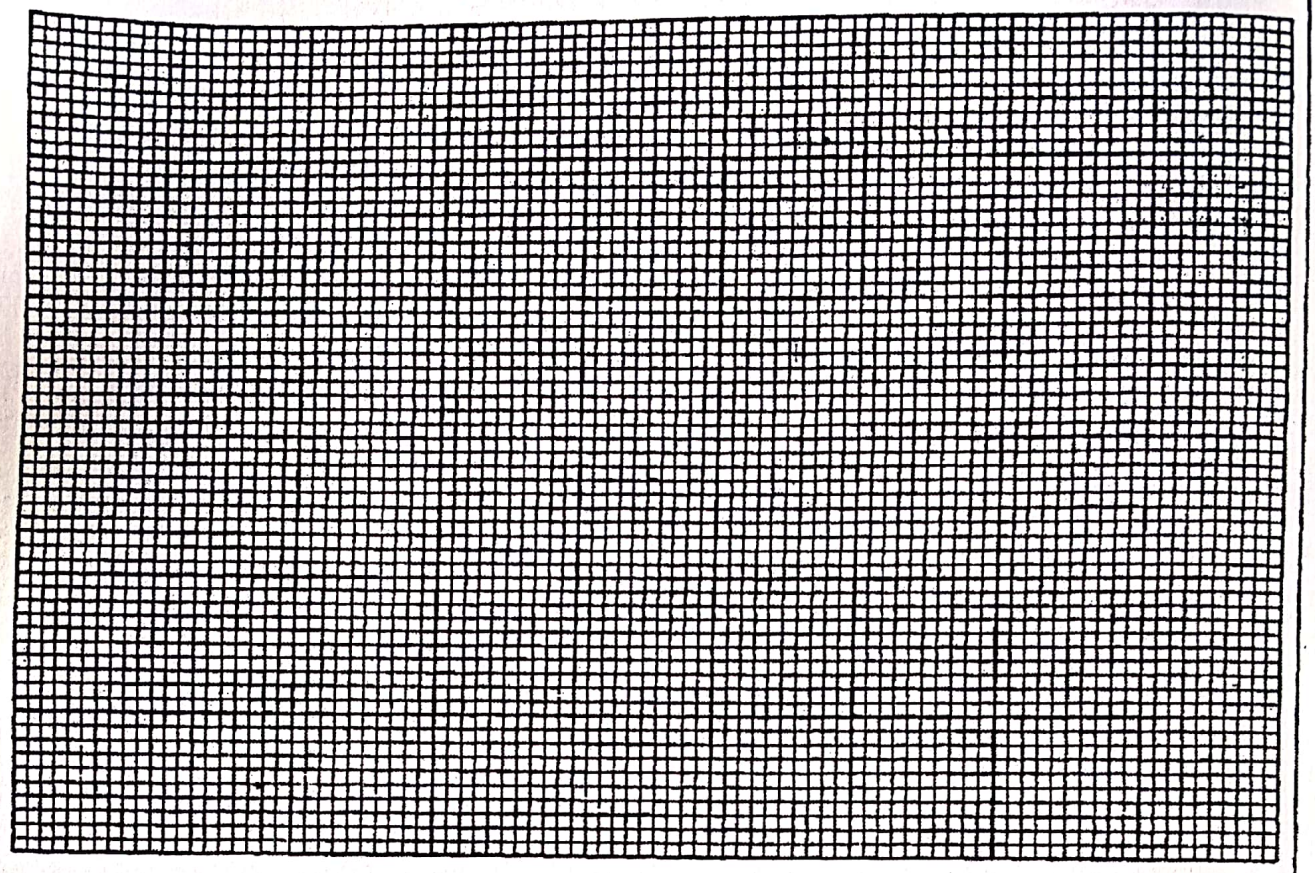
(a) Draw a labelled diagram of the apparatus that can be used to collect and measure the volume of the gas produced.

[2]

(b) Write an equation for the reaction.

_____ [1]

(c) (i) Plot a graph of volume of gas produced against time taken.



[3]

(ii) Estimate the volume of gas produced after 50 minutes.

_____ [1]

(iv) Deduce the rate of reaction in the first 60 minutes of the reaction.

[3]

(v) On the same grid sketch two more graphs to show how the graph would look like when

1. 5.0 g powdered iron is used,

2. 5.0 g of iron granules is used. [2]

[Total: 12]

4 Alkanes are saturated and very unreactive.

(a) Define the term *saturated*.

_____

_____ [1]

(b) Give any three characteristic properties of a homologous series.

1. _____

2. _____

3. _____ [3]

(c) Name one other reaction undergone by alkanes other than combustion.

_____ [1]

(d) (i) Define the term *isomer*.

_____

_____

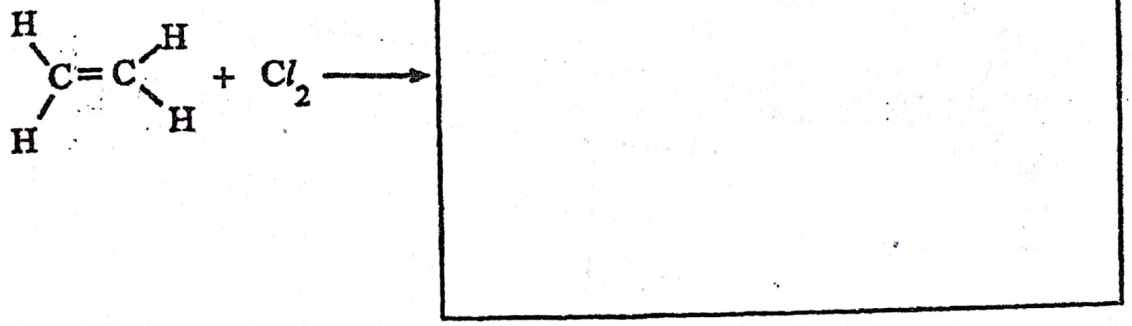
(ii) Draw the structures of the two isomeric alkanes, with the molecular formula C_4H_{10}.

[3]
[Total: 8]

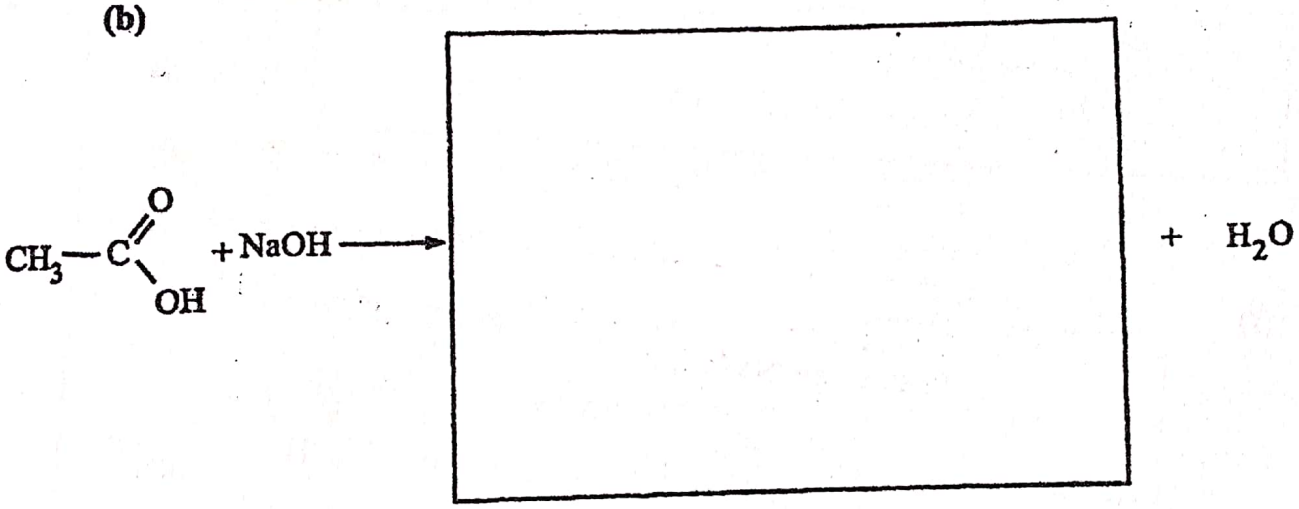
For Examiner's Use

5 Complete the following reaction equations, by filling in the boxes.

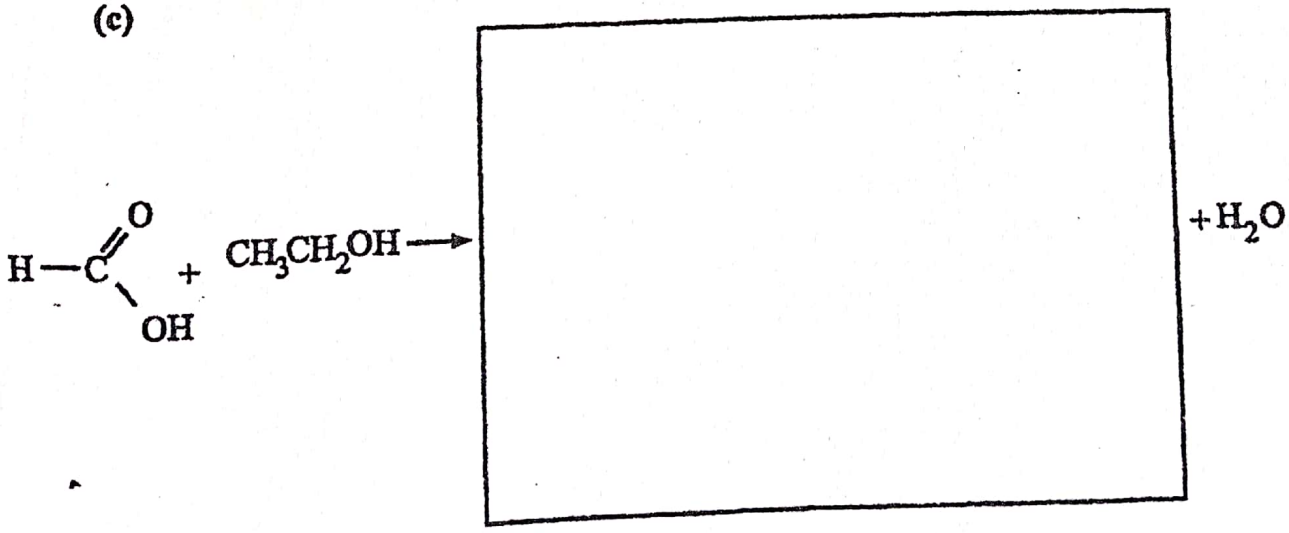
(a)



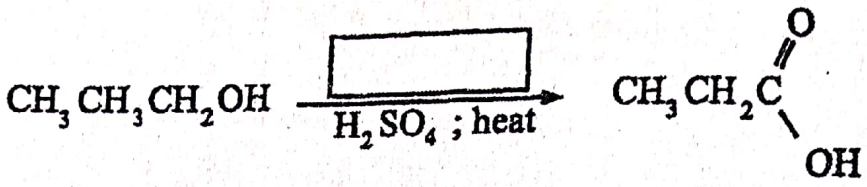
(b)



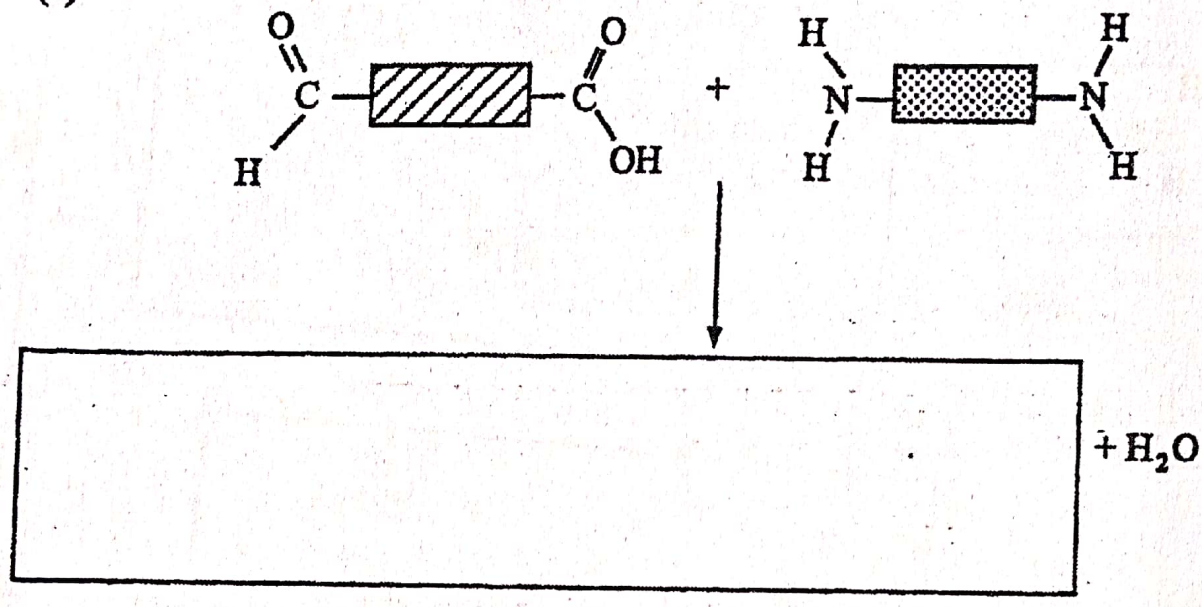
(c)



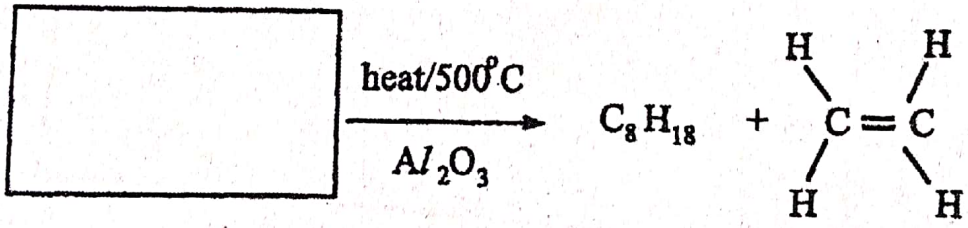
(d)



(e)



(f)



[Total: 6]

Section B

Answer any three questions from this section.

6 **(a)** **(i)** Define the term *electrolysis*.

(ii) Draw a labelled diagram to illustrate the process of electrolysis.

(iii) Describe what happens to ions in the electrolyte when a current is passed through.

[5]

(b) The process of electrolysis is employed in electroplating.

Chromium plating of an iron object can be done using pure chromium (III) sulphate, $Cr_2(SO_4)_3$, as the electrolyte.

(i) Define *electroplating*.

(ii) Write equations to show processes that would occur at

1. the anode,

2. the cathode,

during chromium plating.

(iii) Describe how the reaction taking place at the anode would be affected by replacing the chromium electrode by a carbon electrode.

[5]
[Total: 10]

7 Fig. 1 shows apparatus that may be used to react metals with chlorine.

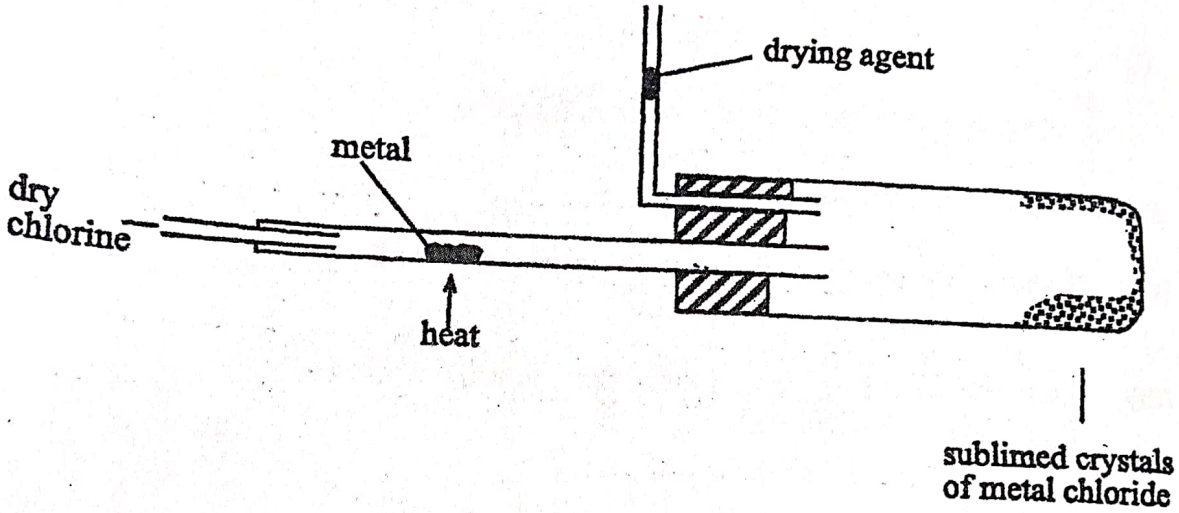


Fig. 1

(a) Name one substance that can be used as the drying agent. [1]

(b) When iron wool is used, the chloride produced contains 34.5% iron.

(i) Define the term *empirical formula*.

(ii) Calculate the empirical formula of the chloride.

(iii) Given that the relative formula mass of the chloride is 325, deduce its molecular formula.

(iv) Use the molecular formula in (iii) to write an equation for the reaction occurring.

[7]

(c) State two differences that would be noted when sodium metal is used in place of iron. [2]

[Total: 10]

8 (a) **Table 2** shows some characteristic properties of diamond and graphite.

Table 2

	diamond	**graphite**
electrical conductivity	poor conductor	very good conductor
hardness	hard	soft
density	3.5 g/cm^3	2.2 g/cm^3

(i) Describe the structure of

1. diamond,

2. graphite.

(ii) Use the structures in (i) to explain the differences in the three physical properties listed in **Table 2**.

[6]

(b) (i) Name **one** natural and **one** artificial polymer of carbon.

(ii) Draw a structure to represent a section of a silicone polymer.

(iii) State any **one** advantage of silicone polymers over carbon polymers.

[4]

[Total: 10]

9 (a) (i) State **one** use of ethanol.

(ii) Describe how ethanol can be produced by the fermentation of glucose.

[4]

(b) Ethanol can be converted to ethene gas and water by passing its vapour over hot aluminium oxide.

(i) Write an equation for this reaction.

(ii) Describe a simple test to show that the gas collected is ethene.

(iii) Suggest, by means of a diagram, how apparatus can be set up to collect the ethene produced by an upward delivery method.

[6]
[Total: 10]

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2014

4024/2

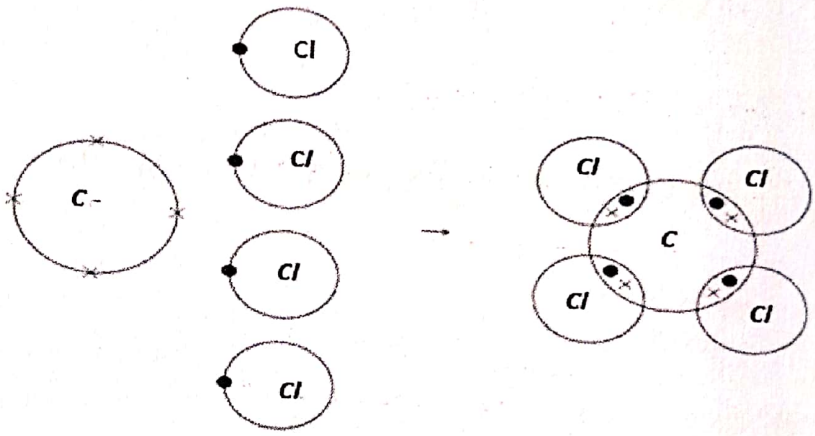
CHEMISTRY

1. **(a)**

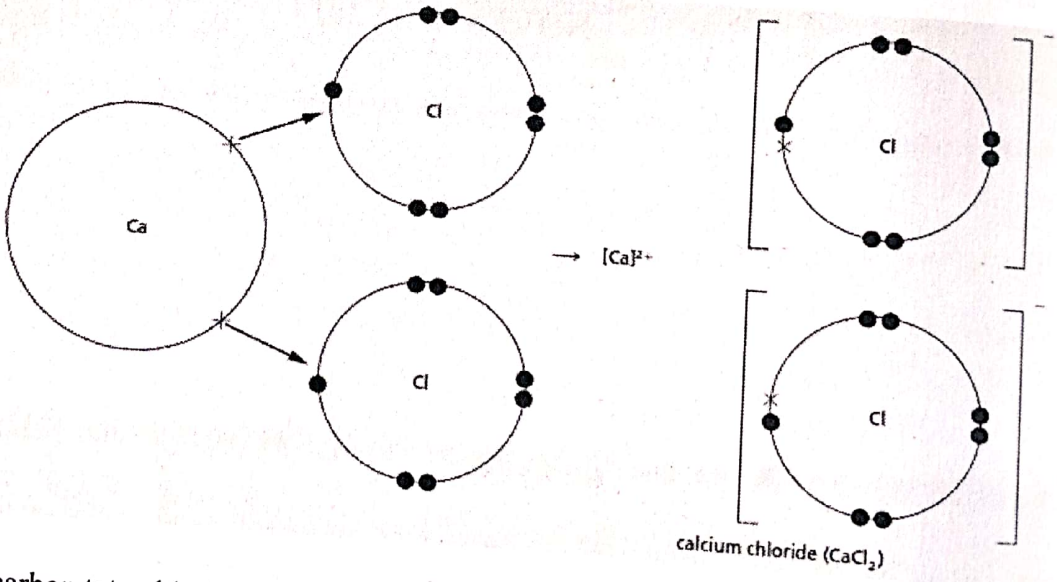
Name of particle	Number
Protons	17
Electrons	17
Neutrons	18

(b) -A chloride ion has an extra electron

(c) (i) 1.



2.



(ii) 1. -carbon tetrachloride molecules are held together by weak forces of attraction compared to strong electrostatic forces between $CaCl_2$.

2. -CCl_2 has no ions nor free electrons. In solution or molten form $CaCl_2$ form mobile ions which are responsible for conductivity.

---

2 (a) (i) precipitation

(ii) Redox

(iii) Neutralisation

(iv) Hydrolysis

(b) (i) (v) represents the Oxidation number of chlorine

(ii) $2KClO_3 \rightarrow 2KCl + 3O_2$

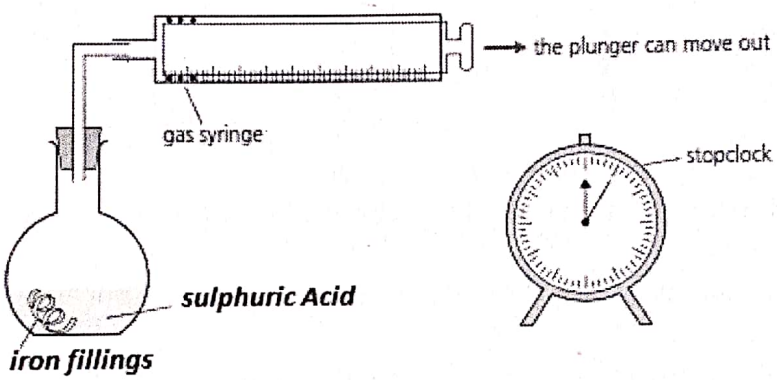
(iii) $n(KClO_3) = \frac{10}{122.5} = 0.08moles$

$n(O_2) = \frac{0.08}{2} \times 3 = 0.12moles$

$Volume\ of(O_2) = 24 \times 0.12 = 2.88dm^3$

---

3. (a)



(b) $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

(c) (i) Plot graph

(ii) volume at 50 mins – Read from graph

(iii) Rate = gradient = $\frac{24.67}{60}/0.411\text{cm}^3\text{min}$

---

4. (a) -Each carbon atom has a maximum possible number of single bonds around it.

(b) 1. They conform to a general formula

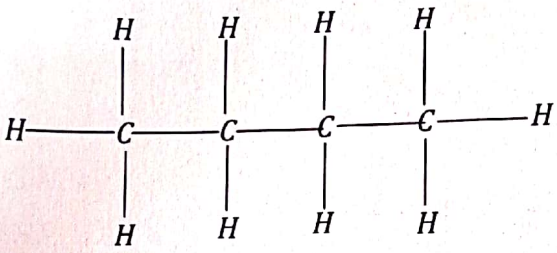
2. They have similar chemical properties

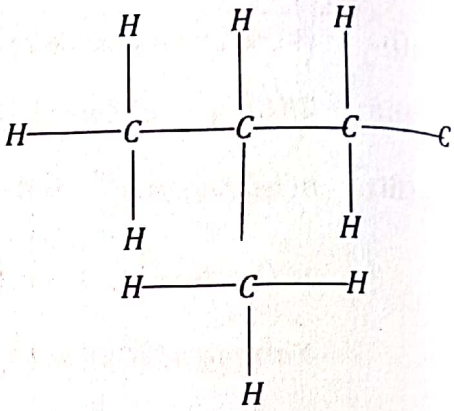
3. They show a gradual change in physical properties

(c) Cracking/ substitution by halogens

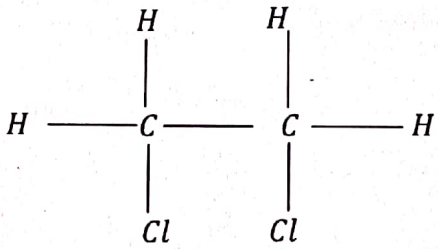
(d) (i) Molecules with the same molecular formulae but different structural formula;

(ii)





5. (a)

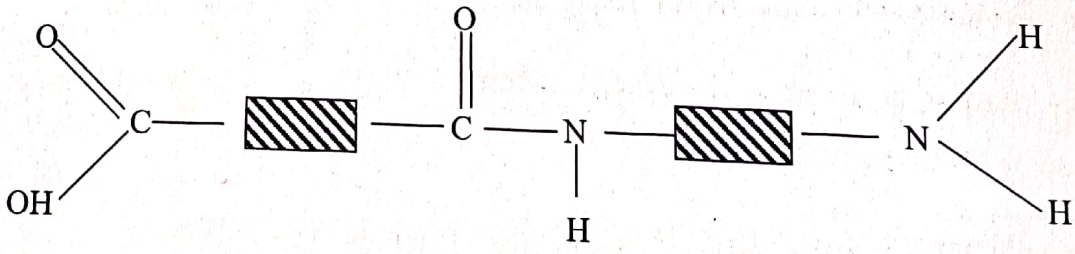


(b) $CH_3COO^-Na^+$

(c) $HCOOCH_2CH_3$

(d) Potassium Dichromate

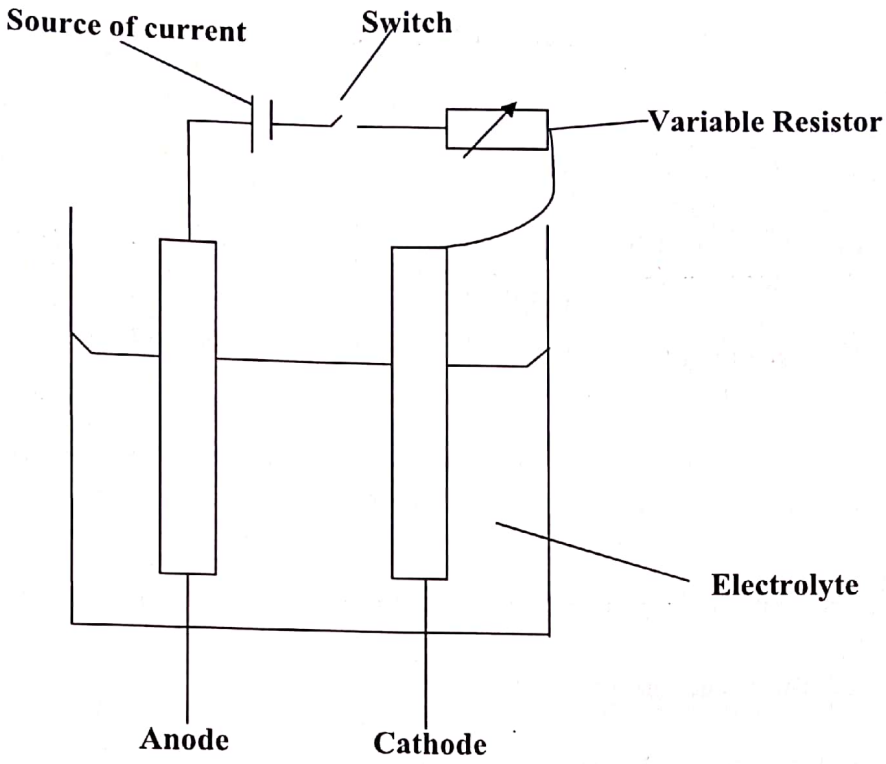
(e)



(f) $C_{10}H_{22}$

6. (a) (i) -The breakdown of an ionic compound by passing current through its molten or solution form

(ii)



(iii) -Cations migrate towards the cathode where they accept electrons and get converted to atoms.

-Anions migrate towards the anode where they give up electrons and get converted to atoms.

(b) (i) -Applying a coating of a specific metal on an article in order to either beautify it or prevent corrosion.

(ii) -anode: $Cr_{(s)} \rightarrow Cr^{3+}_{(aq)} + 3e$

-Cathode $Cr^{3+}_{(aq)} + 3e \rightarrow Cr_{(s)}$

(iii) -At the anode oxygen gas would be produced; as OH^- ions from water get preferentially discharged.

$4OH^- \rightarrow 2H_2O + 4e^- + O_2$

---

7. **(a)** -Anhydrous calcium chloride

(b) (i) -Simplest ratio of atoms in a molecule.

(ii)

Fe	Cl
$\frac{34.5}{56}$	$\frac{65.5}{35.5}$
$\frac{0.62}{0.62}$	$\frac{1.85}{0.62}$
1	3

The empirical formulae is therefore $FeCl_3$

(iii) Let the molecular formula be Fe_nCl_{3n}

Relative Molecular Mass $= 56n + 3(35.5n)$

$$= 162.5n$$

$$162.5n = 325$$

$$n = 2$$

Therefore molecular formula is Fe_2Cl_6

(c) -The reaction would be more vigorous.

-White crystals form.

---

8. **(a) (i)** Diamond:

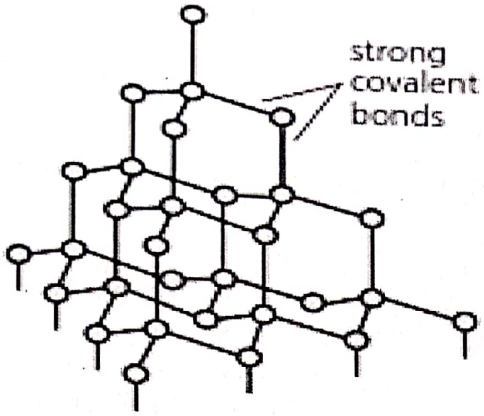
-Each carbon atom is covalently bonded to 4 others.

-The structure extends in 3dimensions.

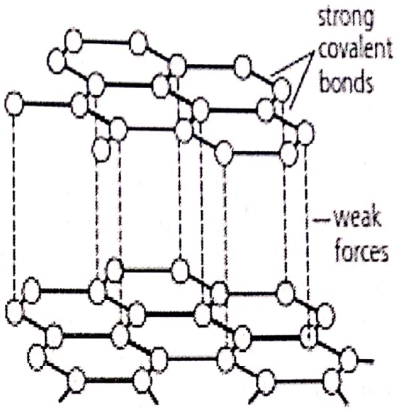
Graphite:

-Each carbon atom is covalently bonded to 3 others forming hexagonal layers.

-Separate layers are held together by weak forces of attraction.



Diamond



Graphite

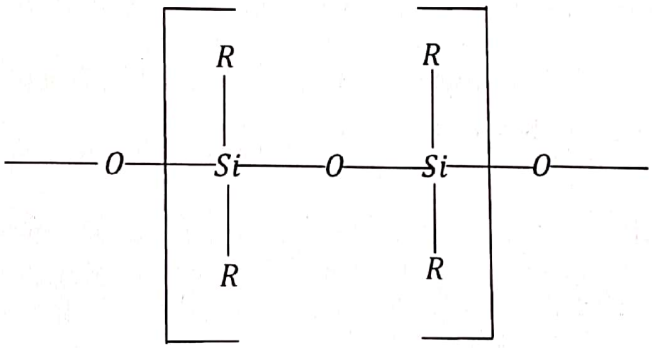
(ii) - Graphite has delocalised electrons along layers hence good conductor.
-Diamond has no free electrons hence it's a poor conductor

-Layers of graphite can easily slide over each other making graphite relatively soft
-The rigidity of carbon bonds in diamond make it hard.

-weak forces between layers of graphite make distance between layers larger hence graphite has a lower density.

(b) (i) Natural polymer: protein/starch/cellulose/fats/silk/hair/finger nails

(ii)



(iii) -They are fire resistant

---

9. (a) (i) -Fuel
-Alcoholic Beverages
-Medicines

(ii) $Yeast + Starch \rightarrow Alcohol$

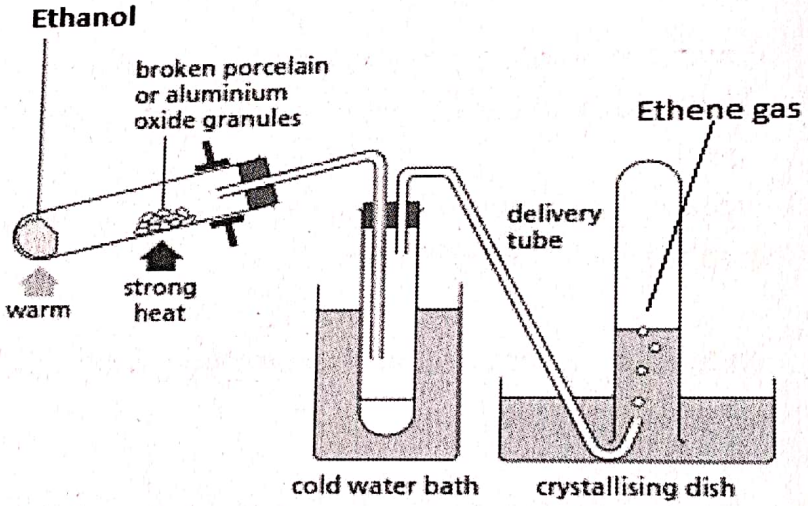
-Enzyme catalyse convert starch to glucose and the ethanol and carbon dioxide gas is also produced as a by product

$$C_6H_{12}O_{6(aq)} \xrightarrow[\text{Yeast}]{\text{Enzyme}} 2CH_3CH_2OH + 2CO_2 + energy$$

(b) (i) $$CH_3CH_2OH \xrightarrow{Al_2O_3\ hot} CH_2CH_{2(g)} + H_2O_{(g)}$$

(ii) -Pass the gas through bromine water. The bromine is decolourised

(iii)



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/1

PAPER 1 Multiple Choice

NOVEMBER 2015 SESSION 1 hour

Additional materials:
- Mathematical tables and/or electronic calculator
- Multiple Choice answer sheet
- Soft clean eraser
- Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D.** Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 12.

This question paper consists of 12 printed pages.

[Turn over

1 Which process involves a change of state?

A filtration
B chromatography
C sublimation
D diffusion

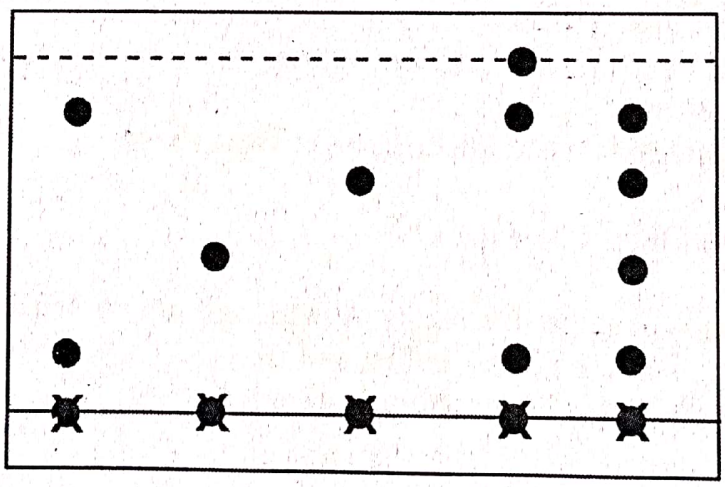
2 When liquid water changes into steam, the molecules

A break up into small particles.
B become very large.
C move further apart.
D give out heat energy.

3 Which apparatus would be most suitable for measuring 16.75 cm^3 of a liquid?

A a bulb pipette
B a burette
C a measuring cylinder
D a volumetric flask

4 The diagram shows a chromatogram of the dyes present in five different inks.



What is the total number of different dyes inall the five inks?

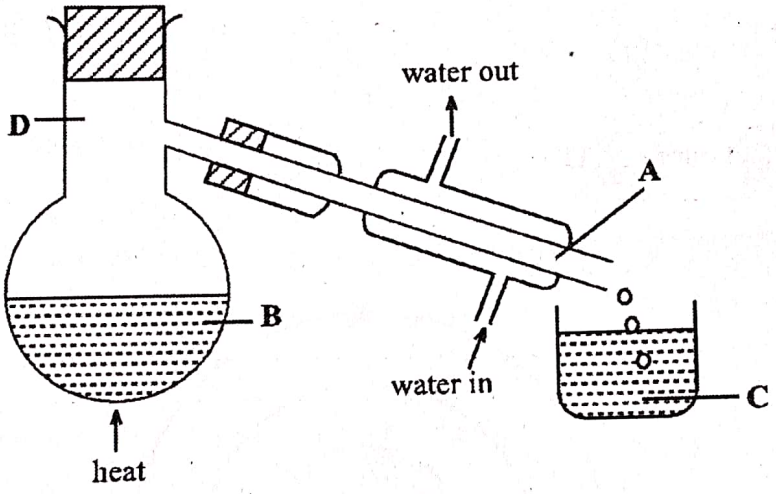
A 3
B 4
C 5
D 11

5 Which property allows substances to be separated by paper chromatography?

A different solubilities
B different colours
C equalsolubilities
D different boiling points

6 The diagram shows the distillation of a salt solution.

At which point would the temperature be equal to the boiling point of water?



7 Graphite conducts electricity because

A it contains electrons that are free to move.
B it contains protons that are free to move.
C the layers of atoms can slide over each other.
D it contains impurities.

8 Elements are systematically arranged in the Periodic Table in the order of increasing

A nucleon number.
B proton number.
C valency number.
D number of neutrons.

9 Which pair of atoms has the same number of neutrons?

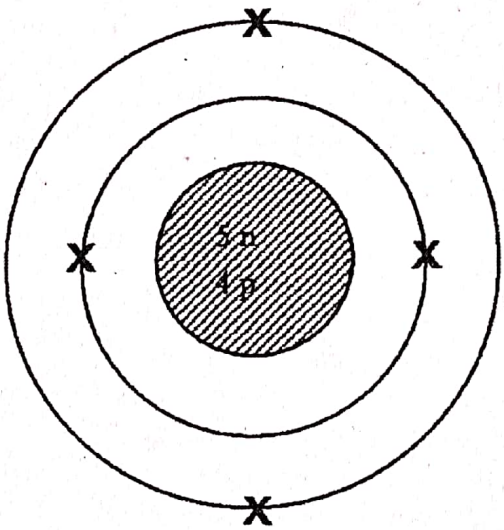
A $^{15}_{7}N$ and $^{14}_{7}N$

B $^{23}_{11}Na$ and $^{23}_{12}Mg$

C $^{14}_{6}C$ and $^{16}_{8}O$

D $^{235}_{92}U$ and $^{238}_{92}U$

10 The structure of an atom is shown.



Which statement about this atom is correct?

A It is not a neutral atom.
B Its nucleon number is 13.
C It has 4 valency electrons.
D It forms ions of a charge of +2.

11 Theelement francium, Fr, is in the same group of the Periodic table as potassium. The formula of francium chloride is likely to bc

A Fr_2Cl
B $FrCl$
C $FrCl_2$
D $FrCl_3$

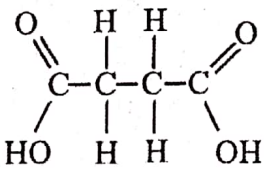
12 The proton number of element X is 19. When X forms an ionic compound, the electronic structure of the ion formed by X is

A 2, 8, 8.
B 2, 8, 8, 1.
C 2, 8, 8, 2.
D 2, 8, 8, 3.

13 Which equation is balanced?

A $CO + O_2 \rightarrow CO_2$
B $2CO + 2O_2 \rightarrow 2CO_2$
C $CO + O_2 \rightarrow 2CO_2$
D $2CO + O_2 \rightarrow 2CO_2$

14 The structural formula of butanedioic acid is shown.



Which statement about butanedioic acid is **not** true?

A Its molecular formula is $C_4H_6O_4$.
B It contains 3 types of elements.
C Its molecular and empirical formulae are the same.
D One molecule contains 14 atoms.

15 What is the ionic equation for the reaction between sodium hydroxide and hydrochloric acid?

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

B $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

C $Na^+_{(aq)} + Cl^-_{(aq)} \rightarrow NaCl_{2(aq)}$

D $H^+_{(aq)} + Cl^-_{(aq)} \rightarrow HCl_{2(aq)}$

16 A compound contains 33.3% carbon and 66.7% oxygen.

The empirical formula of the compound is

A CO_2.

B C_2O_3.

C C_3O_2.

D CO_3.

17 Sodium hydrogen carbonate decomposes on heating as shown

$$2\,NaHCO_3 \rightarrow Na_2CO_{3(s)} + H_2O_{(l)} + CO_{2(g)}$$

What is the volume of gas produced at r.t.p, from the decomposition of 4 moles of sodium hydrogen carbonate?

A $22.40\,dm^3$

B $28.00\,dm^3$

C $44.80\,dm^3$

D $56.00\,dm^3$

18 What is the number of chlorine molecules in 35.5 g of chlorine gasif the number of molecules in one mole of a gas is x. ?

A $0.5\,x$

B x

C $2x$

D $35.5x$

19 A chloride ion, Cl^-, has the same number of electrons as

A Br^-.
B F.
C Ar.
D O^{2-}.

20 During electrolysis, cations move towards the

A cathode.
B anode.
C electrolyte.
D battery.

21 An object is electroplated with copper.

Which statement about the process is correct?

A The concentration of copper ions in the electrolyte increases.
B Copper is used as the cathode.
C Copper ions gain electrons from the object being electroplated.
D Oxygen is evolved at the anode.

22 Which reaction takes place when a photographic film is exposed to light?

A $2Ag + Br_2 \rightarrow 2AgBr$
B $Ag^+ + e^- \rightarrow Ag$
C $Br_2 + 2e^- \rightarrow 2Br^-$
D $Ag^+ + Br^- \rightarrow AgBr$

23 In the equilibrium reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, which substance(s) will be present in the equilibrium mixture?

A NH_3 only
B N_2, H_2 and NH_3
C N_2 and H_2 only
D H_2 only

24 Which row correctly gives the correct number of protons, neutrons and electrons of the ion.

	ion	protons	neutrons	electrons
A	$^{9}_{4}Be^{2+}$	4	5	4
B	$^{19}_{9}F^{-}$	9	10	10
C	$^{27}_{13}Al^{3+}$	13	14	13
D	$^{35}_{17}Cl^{-}$	17	18	16

25 A solution of an alkali in water

A has a pH less than 7.
B turns blue litmus paper red.
C contains hydroxide ions.
D neutralises a salt to produce an acid.

26 What is the oxidation state of nitrogen in N_2O_3?

A +6
B +3
C −3
D −2

27 Which element is always found in steel?

A carbon
B chromium
C nickel
D silicon

28 Brass is an alloy of

A lead and tin.
B zinc and copper.
C iron and carbon.
D iron and aluminium.

29 Molten cryolite, Na_3AlF_6, is used in the extraction of aluminium because

A it lowers the melting point of aluminium oxide.
B it dissolves the aluminium oxide.
C it increases the melting point of aluminium oxide.
D it increases the purity of aluminium.

30 Which **one** is **not** an air pollutant?

A nitrogen
B carbon monoxide
C nitrogen oxide
D vaporised lead compounds

31 Which element is used to purify water for domestic purposes?

A iodine
B chlorine
C fluorine
D bromine

32 In the manufacture of sulphuric acid by the contact process, the sulphur trioxide is dissolved in

A water.
B dilute sulphuric acid.
C concentrated sulphuric acid.
D oleum.

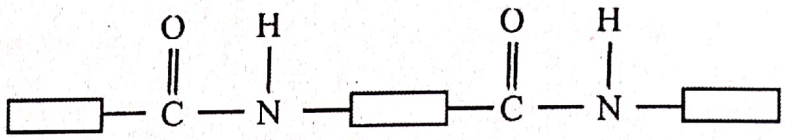
33 Which catalyst is used in the manufacture of nitric acid?

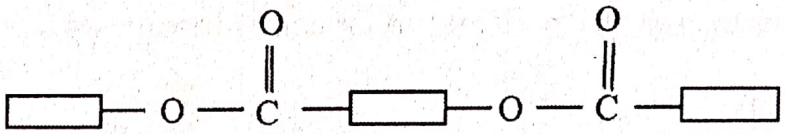
A vanadium pentoxide
B platinum
C iron
D nickel

34 What type of a compound is formed when an element P(proton number 12) reacts with an element Q(proton number 17)

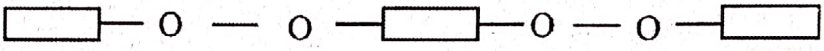
A a covalent compound of formula PQ
B a covalent compound of formula PQ_2
C an ionic compound of formula PQ_2
D anionic compound of formula P_2Q

35 Which structure has an ester bond?

A 

B 

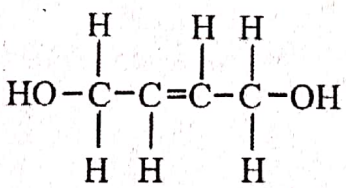
C 

D 

36 Polyethene and ethane have the same

A empirical formula.
B relative molecular mass.
C molecular formula.
D reaction towards aqueous bromine.

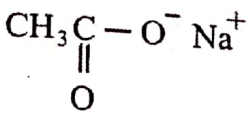
37 The structure of a compound is shown.

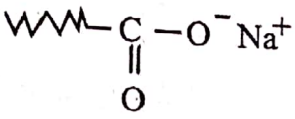


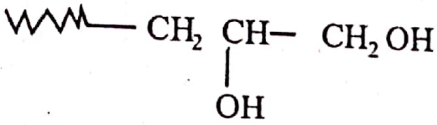
The compound can be classified asan

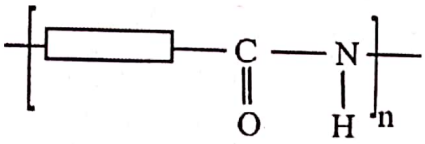
A acid and an alkene.
B alcohol and an alkene.
C acid and an alcohol.
D ester and an alkene.

38 Which structure represents a soap molecule resulting from the hydrolysis of fat with aqueous sodium hydroxide?

A 

B 

C 

D 

39 Which one is an advantage of using herbs over conventional medicines?

A herbs are readily available and cheaper
B herbs are more effective
C herbs are not toxic
D herbs are obtained in a natural form

40 Which method is not recommended for the disposal of non-biodegrable waste ?

A reusing
B bioremediation
C burning
D an esterification

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Ordinary Level

EXPECTED ANSWERS

CHEMISTRY	NOV 2015	5071/1

1	C
2	C
3	B
4	C
5	A
6	D
7	C
8	B
9	C
10	D
11	B
12	A
13	D
14	C
15	B
16	B
17	D
18	A
19	C
20	A

21	D
22	B
23	B
24	B
25	C
26	B
27	A
28	B
29	A
30	A
31	B
32	C
33	B
34	C
35	B
36	C
37	B
38	B
39	C
40	C

Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 4024/2

PAPER 2 Theory

NOVEMBER 2015 SESSION 1 hour 45 minutes

Candidates answer on the question paper.

Additional materials: Electronic calculator

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and centre number and candidate number on top of the right corner of every page of this paper. Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **four** questions.

Write your answers on the spaces provided on the question paper

Do not fasten the booklet

INFORMATION FOR CANDIDATES

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

A copy of the periodic table is on page 20.

This question paper consists of 20 printed pages.

[Turn over

Section A

*Answer **all** the questions in the spaces provided.*

1 **(a)** A student prepared a blue solution, **P**, by adding black copper (II) oxide powder to nitric acid as shown in **Fig.1.1**.

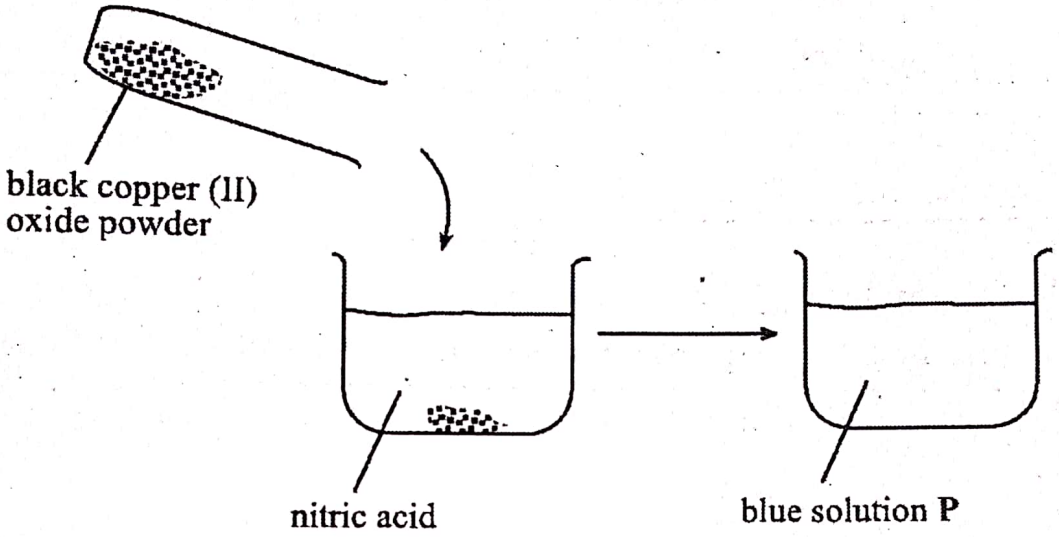


Fig.1.1

(i) Name **two** chemical substances in the blue solution.

1. _____

2. _____ [2]

(ii) State **two** observations made by the student.

1. _____

2. _____ [2]

(iii) Write a balanced chemical equation for the reaction.

_____ [2]

1 **(b)** Write a balanced chemical equation for the reaction that will occur when

(i) zinc granules are added to copper sulphate solution,

_____ [1]

(ii) calcium carbonate is heated strongly.

_____ [1]

[Total:8]

2 **(a)** In a titration, 25 cm^3 of aqueous ammonia required 21.50 cm^3 of 0.1 mol dm^{-3} sulphuric acid for complete neutralisation. The equationfor the reaction is:

$$H_2SO_{4(aq)} + 2NH_4OH_{(aq)} \rightarrow (NH_4)_2SO_{4(aq)} + 2H_2O_{(aq)}$$

(i) Calculate the number of moles of sulphuric acid in 21.50 cm^3 of the solution.

[2]

(ii) Deduce the number of moles of ammonia in the 25 cm^3 of ammonia.

_____

_____

_____ [2]

(iii) Calculate the concentration of the ammonia solution.

[2]

(b) **(i)** Give **one** physical property in which the oxides, CO_2 and SO_2, are similar.

_____ [1]

(ii) Name the industrial process by which $CO_{2(g)}$ is obtained from air.

_____ [1]

[Total :8]

3 (a) **Table. 3.1** showssome of the gaseous pollutants.

Complete **Table 3.1** by stating a use and an effect of the gases on the environment.

gas	use	effect on the environment
CO_2		
SO_2		

[4]

3 (b) Explain why **no** chemical reaction takes place when

(i) aluminium powder that has been exposed to air is added to a solution of iron (II) sulphate,

_____

_____ [1]

(ii) magnesium powder is added to a solution of calcium chloride,

_____

_____ [1]

(iii) zinc oxide is heated in a stream of hydrogen,

_____

_____ [1]

(iv) carbon dioxide is bubbled through a solution of hydrochloric acid.

_____

_____ [1]

[Total:8]

4 (a) **Fig.4.1** shows how an organic compound, **Q**,is produced from ethene.

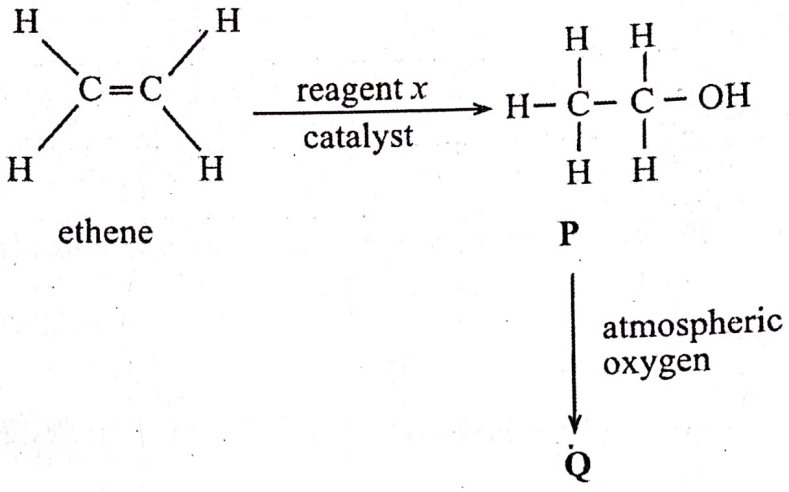


Fig.4.1

(i) Name

1. reagent *x*, _____

2. compound **P**. _____ [2]

(ii) Draw the displayed structural formula of **Q**.

[1]

(iii) Give any**two** uses of **P**.

1. _____

2. _____ [2]

4 (a) (iv) Describe anyone chemical test that is used to distinguish ethenefromP.

_____

_____

_____ [1]

(b) **Fig.4.2** shows the structure of a protein molecule.

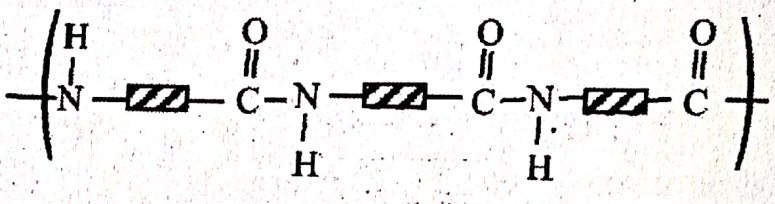


Fig.4.2

(i) Name the smaller units (monomers) that make up the protein molecule.

_____ [1]

(ii) Describe how the protein molecule can be broken down into the smaller units.

_____

_____ [1]

[Total:8]

5 **Fig.5.1** shows a set up of apparatus that was used to identify a blue pen that was used to write a bad message by a student.The ink that was used to write the message is marked **M.** Sample inks 1,2 and 3 were taken from pens suspected to have been used.

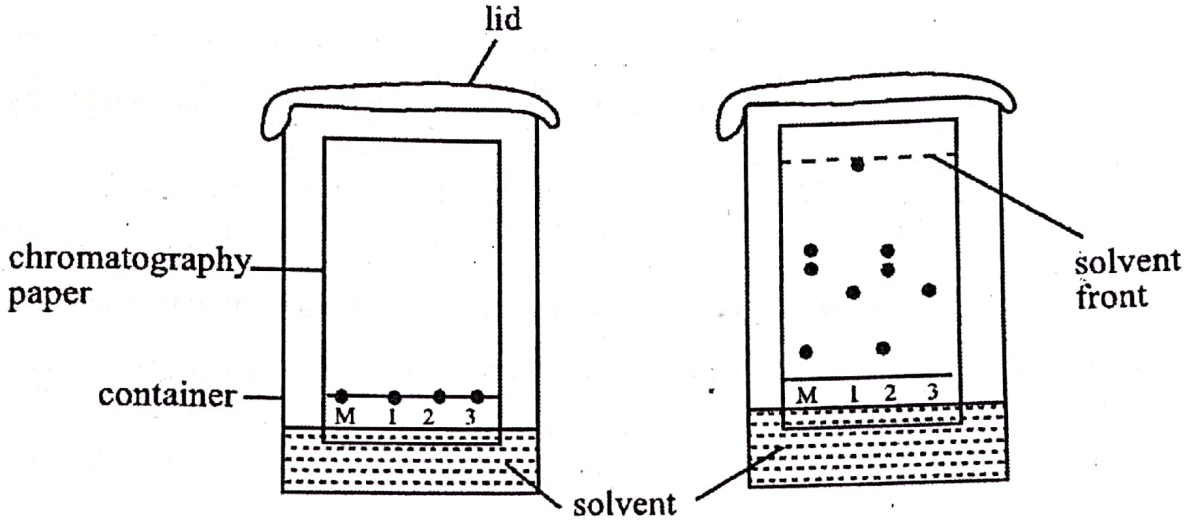


Fig.5.1

(a) **(i)** State the number of dyes in ink **M.**

_____ [1]

(ii) Describe **one** difference and **one** similarity between inks in samples 1 and 3.

difference _____

_____

similarity _____

_____ [2]

5 (a) (iii) Identify with reasons the sample ink that could have been used to write the bad message.

ink _____

reason _____ [1]

(b) (i) Name **one** property that determines the distance travelled by a dye in chromatography.

_____ [1]

(i) The solvent travelled 8.0 cm and the dye in ink 3 travelled 3.0 cm.

Calculate the R_f value of the dye into 3.

[1]

(iii) State the importance of R_f values.

_____

_____ [1]

(c) Explain why the container in **Fig.5.1** was covered.

_____ [1]

[Total: 8]

Section: B

*Answer any **four** questions from this section.*

6 **(a)** Define the term *ionic bonding*.

_____

_____ [2]

(b) The table shows some physical properties of three compounds.

compound	electrical conductivity	melting point
naphthalene	does not conduct	low
copper (II) chloride	good conduction when in solution	high
ethane	does not conduct	low

(i) Explain why

1. copper (II) chloride has a higher melting point than ethane,

_____

_____

_____ [2]

2. naphthalene does not conduct electricity.

_____

_____

_____ [3]

6 (b) (ii) Describe and explain what happens when

1. solid naphthalene is added to water,

_____

_____ [2]

2. an electric current is passed through a concentrated solution of copper (II) chloride

_____

_____ [2]

(c) Element **X** has 9 protons and 10 neutrons.

(i) Draw a diagram showing the full electronic structure of X,

(i) State **two** physical properties of the compound formed when X reacts with sodium

1. _____

2. _____ [2]

[Total:15]

7 **(a)** Cast iron from the blast furnace contains 4 to 5 % carbon and other impurities.

(i) Name **one** other impurity in cast iron.

_____ [1]

(ii) Describe how the impurities are removed in the oxygen lance furnace.

_____

_____ [3]

(b) The structural formulae of butenedioic acid is shown in **Fig. 7.1.**

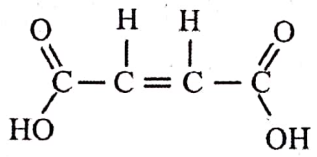


Fig. 7.1

(i) Give the empirical formulae of butenedioicacid

_____ [1]

(ii) Describe how butenedioic acid reacts with

1. aqueous bromine

_____ [1]

2. sodium carbonate

_____ [1]

3. Magnesium

_____ [1]

7 (b) (iii) Draw the structural formula of the product formed when butenedioic acid reacts with bromine.

[1]

(c) **Fig.7.2** shows the reaction ofethene molecules to produce **N**.

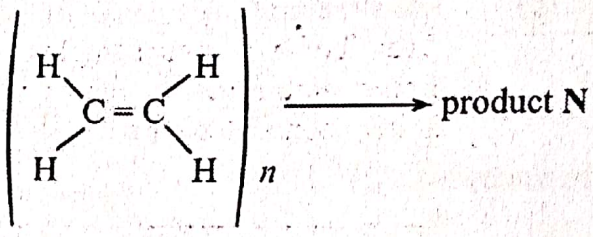


Fig. 7.2

(i) Name

1. this type of reaction,

_____ [1]

2. product **N**.

_____ [1]

(ii) Draw the displayed structural formula of **N**.

[1]

7 (c) (iii) State any **two** uses of the product **N**.

1. _____

2. _____ [2]

(iv) Describe how product**N** can be safely disposed from the environment.

_____

_____ [3]

[Total: 15]

8 (a) Describe how a pure sample of sodium chloride can be prepared fromsolutions of hydrochloric acid and sodium hydroxide of known concentrations.

_____

_____

_____

_____

_____ [4]

8 (b) Fig.8.1 shows chemical tests carried out on a salt to identify the ionspresent in the salt.

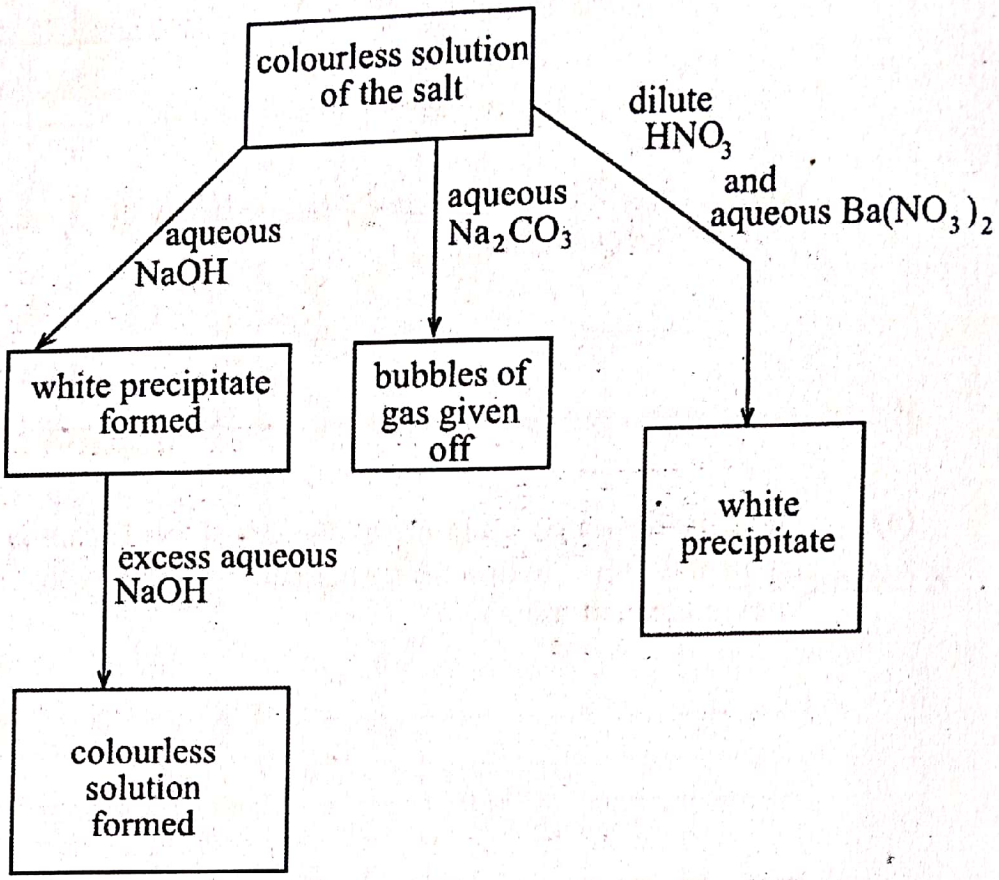


Fig.8.1

8 (b) (i) Deduce the cations and anions in the salt.

cations _____ [2]

anions _____ [2]

(ii) Iodide ions were suspected to be present in the salt.

Describe a chemical test and observations to show the presence of the iodide ions.

_____

_____

_____

_____ [3]

8 (c) A student placed a few calcium granules in a flask containing cold water coloured with universal indicator. The gas given off was collected in a measuring cylinder inverted in water as shown in **Fig. 4.**

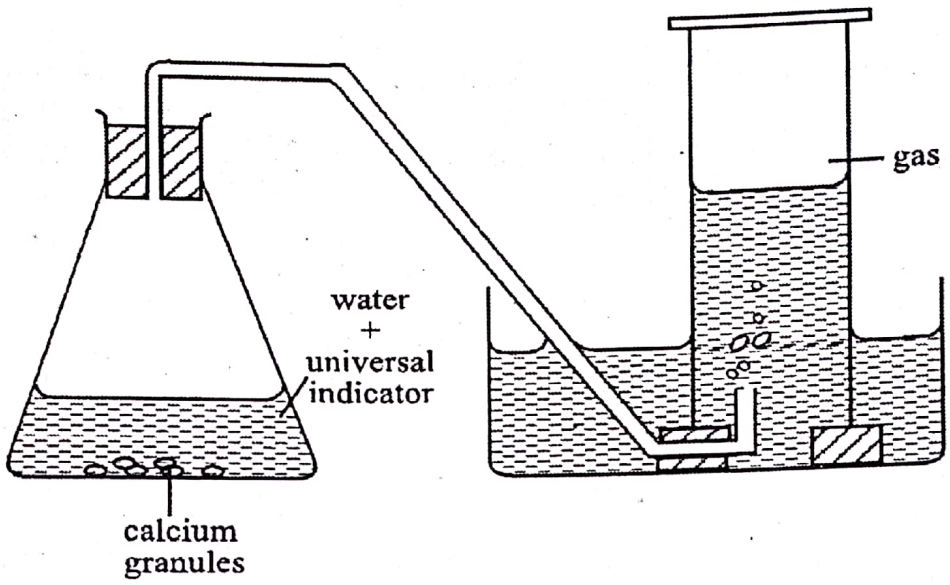


Fig. 4

(c) (i) State and explain any **one** observable change that occurs in the flask.

observation _____

_____

explanation _____

_____ [2]

(ii) Name the gas produced.

_____ [1]

(iii) Describe a test for the gas produced.

_____

_____

_____ [1]

[Total:15]

9 **Fig.5** shows the main steps in the manufacture of sulphuric acid.

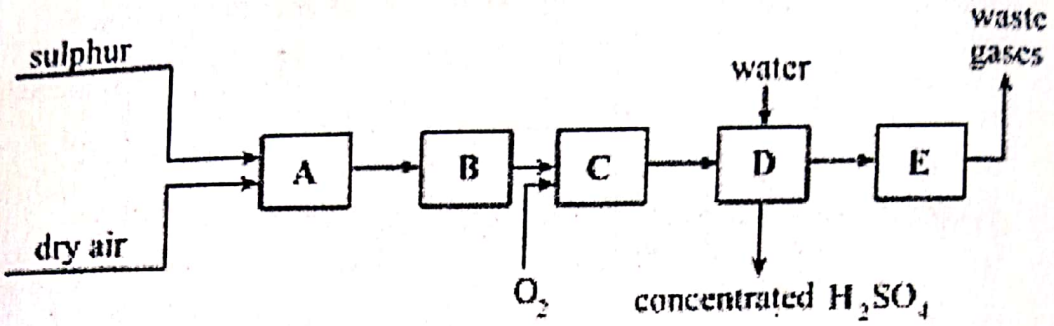


Fig.5

(a) **(i)** Choose from the letters **A - E**, the box that would be labelled

1. catalytic converter,

_____

2. chimney,

_____

3. purifier.

_____ [3]

(ii) Identify **one** error on the flow diagram and describe how this can be corrected.

_____

_____

_____ [2]

9 (a) (iii) State any **one** condition used in **C** and write the overall equation for the reaction which takes place.

condition _____

equation _____ [7]

(b) Describe how sulphuric acid is converted into ammonium sulphate fertilizer.

_____

_____

_____ [3]

[Total:15]

10 (a) State

(i) **two** different physical properties of bromine and iodine.

1. _____

2. _____

(ii) **two** similar chemical chemical properties of bromine and iodine.

1. _____

2. _____

(iii) any **two** uses of chlorine.

1. _____

2. _____ [6]

10 (b) Chlorine reacts with potassium bromide as shown.

$$2KBr_{(aq)} + Cl_{2(g)} \rightarrow 2KCl_{(aq)} + Br_{2(g)}$$

(i) State **one** observation made as the reaction occurs.

_____ [4]

(ii) Name this type of reaction giving a reason for your answer.

type of reaction _____

reason _____ [4]

(c) Explain why

(i) incineration is a controversial method of waste disposal

_____

_____

_____

(ii) the use of landfills as method of waste disposal is being discharged.

_____

_____ [5]

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2015

CHEMISTRY

4024/2

1 **(a)** **(i)** 1. Copper Nitrate ($Cu(NO_3)_2$

2. Copper (II) ions

(ii) 1. Substance soluble in acid

2. Solution turned blue

(iii) $CuO_{(s)} + 2HNO_{3(aq)} \rightarrow Cu(NO_3)_{2(aq)} + H_2O_{(l)}$

(b) **(i)** $Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$

(ii) $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$

2 **(a)** **(i)** $V(H_2SO_4) = 21.50cm^3 = \frac{21.50}{1000} dm^3$

$C(H_2SO_4) = 0.1mol/dm^3$

$n(H_2SO_4) = 0.1 \times \frac{21.50}{1000}$

$= 0.00215\ moles$

(ii) Reaction ratio $H_2SO_4 : NH_4OH = 1:2$

$n(NH_4OH) = 2 \times 0.00215\ moles$

$= 0.0043\ moles$

(iii) $C(NH_4OH) = n/V$

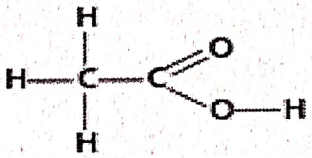
$= 0.0043 / \frac{25}{1\,000}$

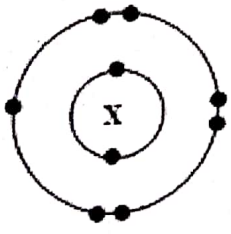
$= 0.172mol/dm^3$

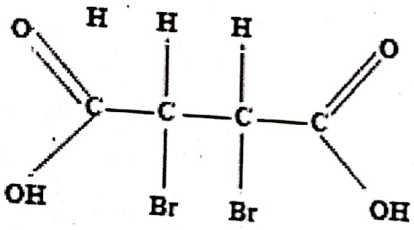
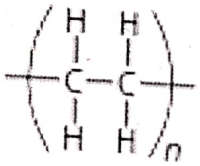
(b) **(i)** They are gases

(ii)

Oxide	Use	Effect on environment
CO_2	• Used by plants for photosynthesis • Fire extinguisher • Dry ice for refrigerators	• Causes global warming
SO_2	• To bleach paper during its manufacture	• Irritates the eyes and causes breathing difficulties

	(c)		Fractional distillation of air
3	(a)	(i)	Left side: Anode Right Side Cathode
		(ii)	Bromine gas
		(iii)	No electrolysis will occur since there are no delocalised (free) electrons to conduct electricity in the solid lead bromide.
	(b)	(i)	Aluminium forms an outer coating that prevents the reaction to take place.
		(ii)	No reaction because magnesium cannot displace calcium since its lower in the reactivity series than calcium.
		(iii)	No reaction because hydrogen is higher than zinc in the reactivity series, hence zinc cannot displace hydrogen.
		(iv)	Carbon dioxide is not soluble in hydrochloric acid since its also acidic
4	(a)	(i)	**1.** Reagent x – water **2.** Compound P – Ethanol
		(ii)	ethanoic acid 
		(iii)	**1.** Used as a fuel **2.** Used as a solvent **3.** Used to make disinfectants
		(iv)	Ethene decolorize bromine water whilst no change with compound P.
	(b)	(i)	Amino Acid
		(ii)	Can be broken down by hydrolysis (Addition of water)
5	(a)	(i)	3 dyes
		(ii)	The dyes have different R_f values

		(ii)	They have a single dye which is the same.
		(iii)	Ink 2 Reason: same type of dyes as M
	(b)	(i)	Solubility in solvent Adsorption in solvent
		(ii)	$R_f = \frac{distance\ travelled\ by\ ink}{distance\ travelled\ by\ solvent}$ $= \frac{3}{8}$ $= 0.375$
		(iii)	Used to identify pure substance by comparing their R_f values with the standard value
	(c)		To prevent evaporation of the solvent
6	(a)		Bond formed between a metal ion and a non metal ion.
	(b)	(i)	1. Copper (II) Chloride has a giant lattice structure that consists of strong ionic bonds which need a lot of heat energy to break than the molecular forces between ethane molecules. 2. Napthlalene has no free electrons (delocalised) to conduct electricity.
		(ii)	1. Insoluble – does not dissolve in water. It solidifies and floats on top of water because its less dense. 2. Copper ions discharged and also chlorine gas. Solution becomes colourless.
	(c)	(i)	
		(ii)	-High melting point -High boiling point -Soluble in water -Conducts electricity in molten state -Compound is hard and crystalline

7	(a)	(i)	carbon
		(ii)	burnt by oxygen and are removed as volatile oxides
	(b)	(i)	CHO
		(ii)	1. Bromine becomes decolourised. 2. It reacts with carbonates releasing carbon dioxide. $Na_2CO_{3(aq)} + 2C_3H_7COOH_{(aq)} \rightarrow 2C_3H_7COONa_{(aq)} + CO_{2(g)} + H_2O_{(l)}$ 3. It reacts slowly with magnesium to form a salt and hydrogen gas. $Mg_{(s)} + 2C_3H_7COOH_{(aq)} \rightarrow Mg(C_3H_7COO)_{2(aq)} + H_{2(g)}$
		(iii)	
	(c)	(i)	1. Addition Polymerisation 2. Poly-ethene
		(ii)	
		(iii)	-Making plastics bags -Making cling film for wrapping food -Making flexible water pipes -Making insulation for electric wires
		(iv)	It should be recycled to make new plastics
8	(a)		-Mix HCl and $NaOH$ -Filter the mixture -Boil to evaporate water -leave the crystal to dry (Crystallize)

	(b)	(i)	Cations: Al^{3+}, Zn^{2+} Anions: : $SO_4{}^{2-}$
		(ii)	-Acidify solution with dilute Nitric acid -Add silver nitrate -A yellow precipitate of silver iodide is formed which is insoluble in ammonia
	(c)	(i)	*Observation*: Calcium granules will disappear, forming a white suspension *Explanation:* Calcium reacts vigorously with cold water.
		(ii)	Hydrogen gas
		(iii)	Use a burning splint and it burns with a pop sound
9	(a)	(i)	**1.** Catalytic Convertor – C **2.** Chimney - E **3.** Purifier -D
		(ii)	Stage B should not be there Remove the stage
		(iii)	-Temperature of 450°C -Pressure of 1 atmosphere -Vanadium (V) Oxide catalyst $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$
	(b)		-Sulphuric acid is mixed with ammonia $H_2SO_{4(aq)} + 2NH_{3(g)} \rightarrow (NH_4)_2SO_{4(aq)}$ -Heat the solution to evaporate -Crystals of ammonium sulphate remain behind
10	(a)	(i)	**1.** Bromine is a liquid while iodine is a solid **2.** Iodine has a higher melting point and boiling point than Bromine
		(ii)	**1.** React strongly with Aluminium **2.** They both don't react with chlorine **3.** They react vigorously with metals to form ionic salts
		(iii)	-water treatment -manufacture of bleaches -making PVC plastics -Making disinfectants

			-Making solvents -Making disinfectants
	(b)	**(i)**	Potassium Bromide which is colourless turns orange
		(ii)	Displacement Reaction *Reason:* Chlorine is more reactive, so it displaces the bromine
	(c)	**(i)**	-It releases toxic fumes into the air -Can release acidic fumes of hydrogen Chloride
		(ii)	-Produces significant quantities of biogas by anaerobic decay of biological materials -The gas seep into the atmosphere where it can form mixture with air -some dumped materials are not biodegradable

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

PAPER 1 Multiple Choice

5071/1

NOVEMBER 2016 SESSION 1 hour

Additional materials:
- Mathematical tables and/or electronic calculator
- Multiple Choice answer sheet
- Soft clean eraser
- Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D.** Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

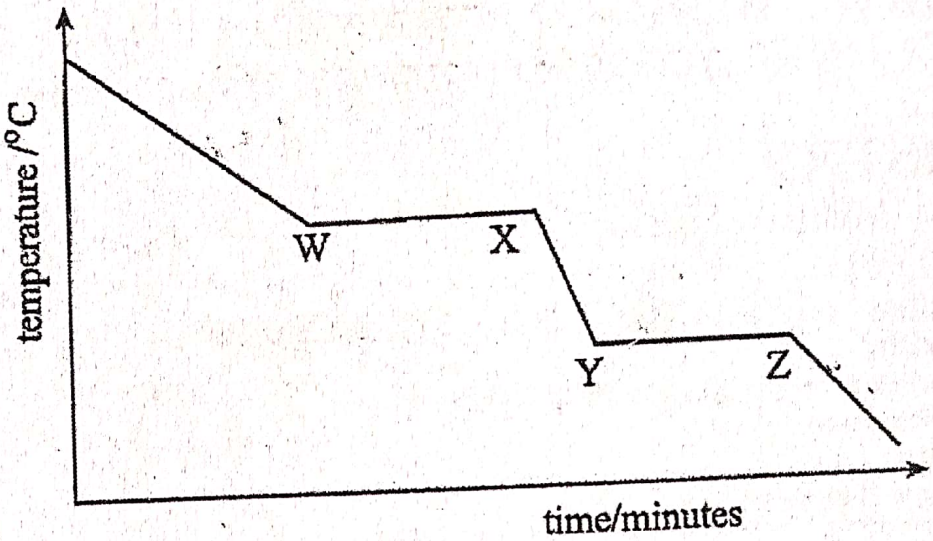
INFORMATION FOR CANDIDATES

Each correct answer will score **one** mark. A mark will **not** be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 17.

This question paper consists of 17 printed pages and 3 blank pages.

[Turn over

1 The graph shows a cooling curve of a substance, P.



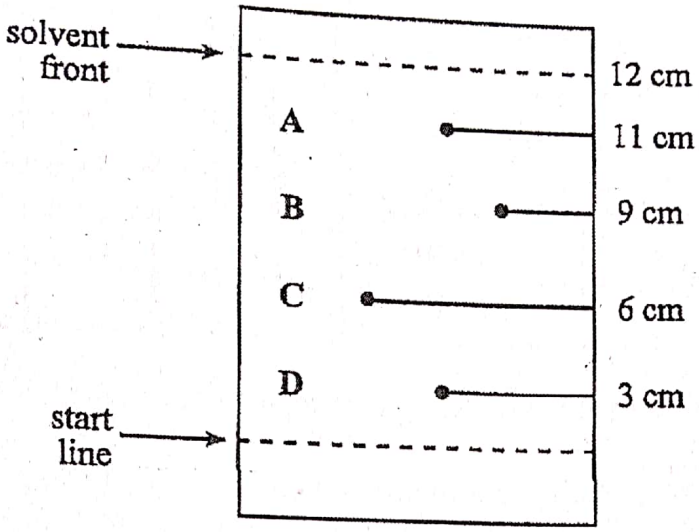
Section YZ represents

A boiling.
B liquefaction.
C melting.
D solidification.

2 Which change of state represents sublimation?

A solid → liquid
B gas → liquid
C liquid → gas
D solid → gas

3 An amino acid has an R_f value of 0.75.



Which of the components **A**, **B**, **C** or **D** in the chromatogram could be the amino acid?

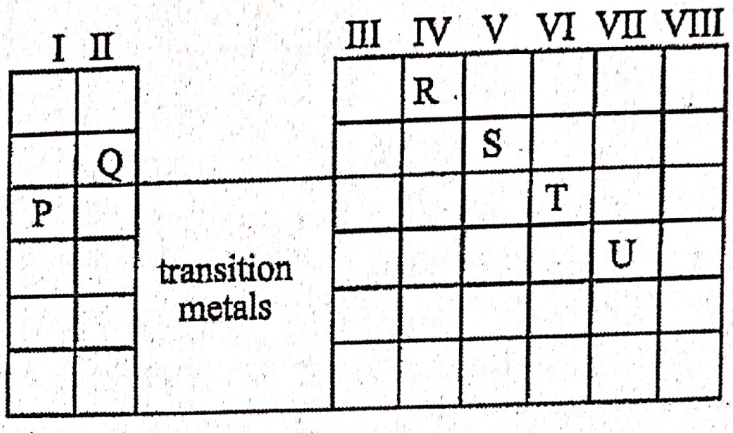
4 The table shows the boiling points of some gases present in the air.

gas	boiling point/°C
argon	−186
carbon dioxide	−78
nitrogen	−198
oxygen	−183

On cooling the air, which gas will be the last to condense?

A argon
B carbon dioxide
C nitrogen
D oxygen

5 The diagram shows the positions of some elements in the Periodic Table.



Which two elements are most likely to react together to form a covalent compound?

A P and Q
B R and T
C Q and R
D Q and S

6 The ion of a non-metal has the symbol X^{2-}.

What will be the formula of the compound formed when it reacts with aluminium?

A Al_2X
B AlX_3
C Al_3X_2
D Al_2X_3

7 Which atom **A**, **B**, **C** or **D** forms an ion with a charge of –2?

atom	proton number
A	6
B	8
C	12
D	15

8 The molecular formula of the compound formed by phosphorus and hydrogen is

A P_5H.
B PH_3.
C P_3H.
D PH_5.

9 What is the mass of potassium iodide, KI, needed to prepare 250 cm^3 of 0.05 mol/dm^3 potassium iodide solution?

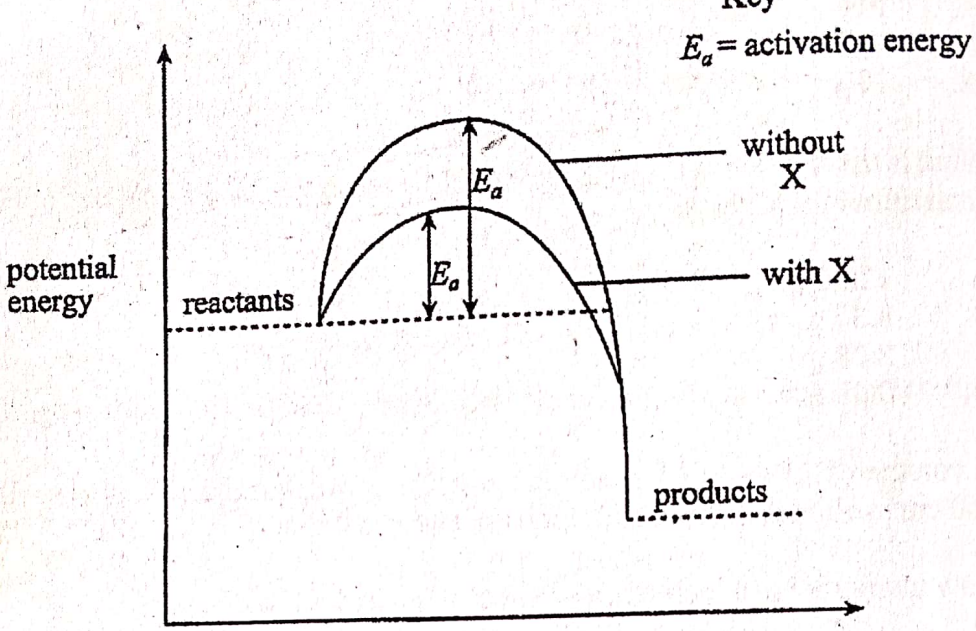
A 12.50 g
B 8.30 g
C 2.08 g
D 0.01 g

10 A volume of 25 cm^3 of 2.0 mol/dm^3 solution of sulphuric acid was transferred to a 250 cm^3 volumetric flask and made up to the mark.

How many moles of sulphuric acid ended up in the flask?

A 0.050
B 0.020
C 0.200
D 0.500

11 The diagram shows the effect of adding substance X to a reaction.



What is the effect of X on the reaction?

A The potential energy of the reaction increases.
B The potential energy of the reaction remains constant.
C The potential energy of the reaction decreases.
D The rate of reaction decreases.

12 A mass of 8.8 g of calcium was reacted with excess aqueous hydrochloric acid to produce calcium chloride, $CaCl_2$.

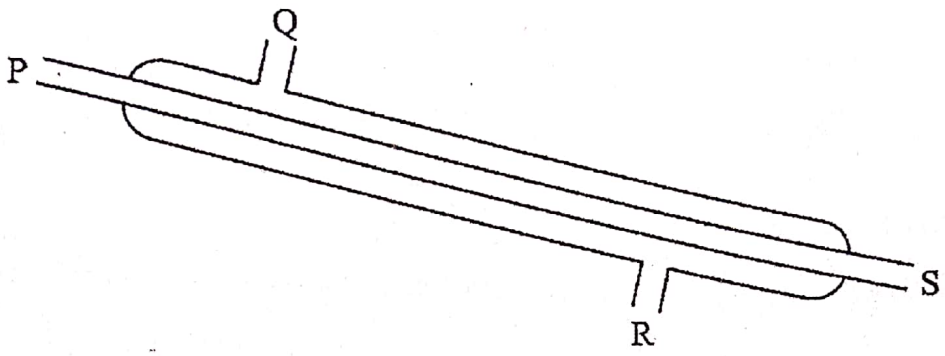
How much calcium chloride was produced?

A 8.80 g
B 2.20 g
C 15.4 g
D 111.0 g

13 What is the concentration of calcium chloride, $CaCl_{2(aq)}$, solution when 11.10 g are dissolved to form 250 cm^3 of solution?

A 0.400 mol/dm^3
B 0.100 mol/dm^3
C 0.025 mol/dm^3
D 4.00 mol/dm^3

14 The diagram shows a Liebig's condenser.



At which point does the cooling water enter the condenser?

A P
B Q
C R
D S

15 The combustion of ethane, $C_2H_{6(g)}$, in excess oxygen is shown by the equation

$$2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 6H_2O_{(g)} + 4CO_{2(g)}$$

What volume of carbon dioxide is formed when 20 cm^3 of ethane is completely burnt?

A 10 cm^3
B 20 cm^3
C 80 cm^3
D 40 cm^3

16 The nucleon number of the isotope of oxygen, $^{18}_{8}O$, is

A 8.
B 10.
C 18.
D 26.

17 Which quantity is the same for one mole of ammonia, NH_3, and one mole of ammonium chloride, NH_4Cl?

A volume at s.t.p
B number of protons
C number of particles
D volume at r.t.p

[Turn over

18 What is the ore from which aluminium is extracted?

A Haematite
B Cryolite
C Pyrites
D Bauxite

19 A drug, amphetamine, has the formula $C_9H_{13}N$.

The relative molecular mass, M_r, of amphetamine is

A 135.
B 108.
C 23.
D 3.

20 A portion of 5 g of marble chips was reacted with excess dilute sulphuric acid.

What would be the effect, on the initial rate and final mass of the product, of using powdered calcium carbonate instead of marble chips?

	initial rate	final mass
A	increases	less
B	increases	remains the same
C	decreases	increases
D	remains the same	remains the same

21 Which electronic configuration is correct for an element in Period 2 of the Periodic Table?

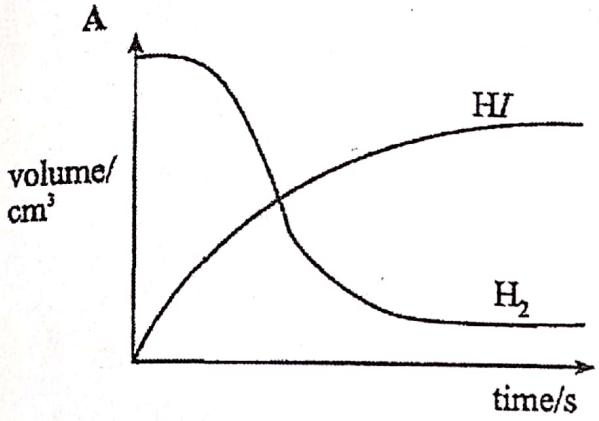
A 1
B 2,1
C 2, 8, 1
D 2, 8, 8, 1

22 Large volumes of hydrogen and iodine are allowed to react until a dynamic equilibrium is established.

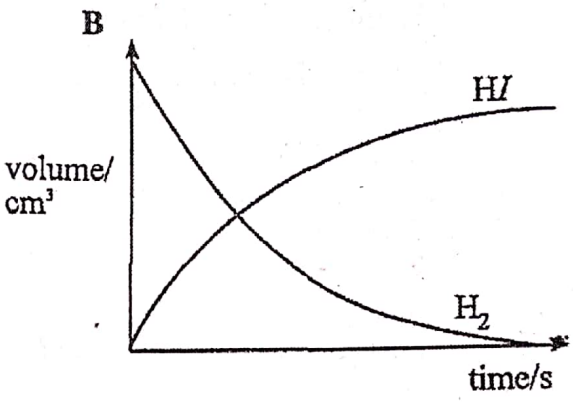
$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$$

Which graph shows the correct information on changes of volume of gases for this reaction?

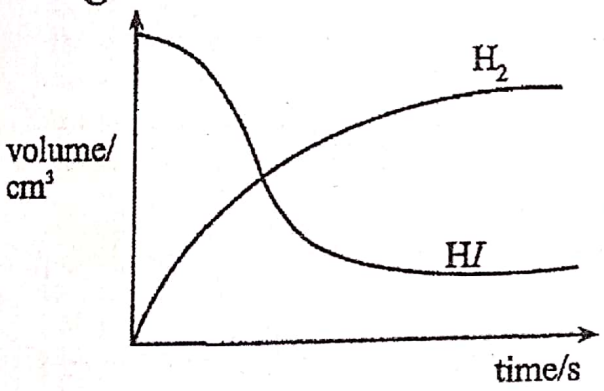
A



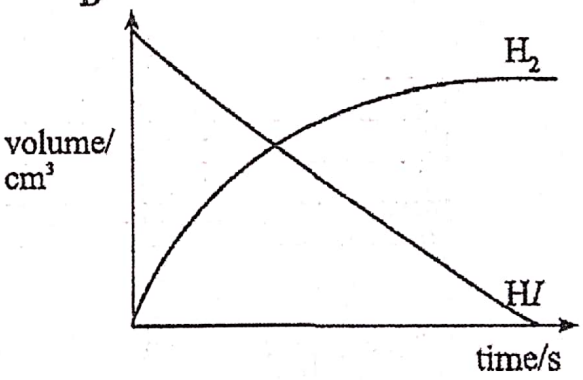
B



C



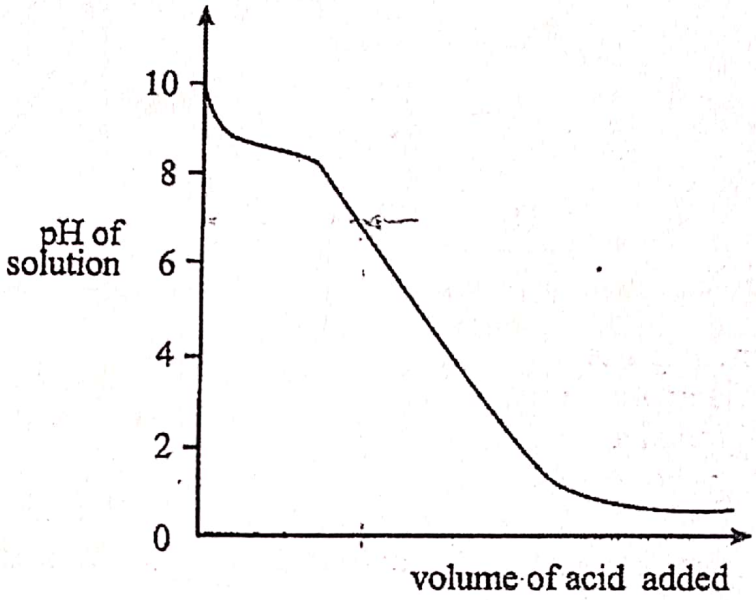
D



23 The reaction between copper (II) oxide and hydrogen is an example of

A an oxidation reaction.
B a reduction reaction.
C a neutralisation reaction.
D a displacement reaction.

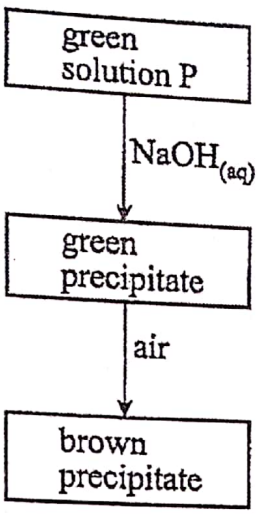
24 The graph shows a titration curve.



This curve can be produced by the titration of

A NaOH and HCl.
B NH_3 and CH_3COOH.
C NH_3 and HCl.
D NaOH and CH_3COOH.

25 The scheme shows some reactions of a solution P.



Solution P could be

A aluminium sulphate.
B iron (II) chloride.
C copper (II) sulphate.
D iron (III) chloride.

26 Which pair of metals will produce the lowest voltage when used as electrodes in a simple cell?

A	copper	silver
B	magnesium	silver
C	magnesium	zinc
D	zinc	copper

27 Which statement explains why pure iron is rarely found in nature?

A iron is very useful in the construction industry
B iron readily combines with oxygen to form an oxide
C iron readily combines with carbon dioxide to form a carbonate
D iron readily combines with water to form an oxide

28 Which process does **not** use oxygen?

A combustion of fossil fuels
B oxidation of metals
C photosynthesis in plants
D respiration in animals

29 Why does graphite act as a lubricant?

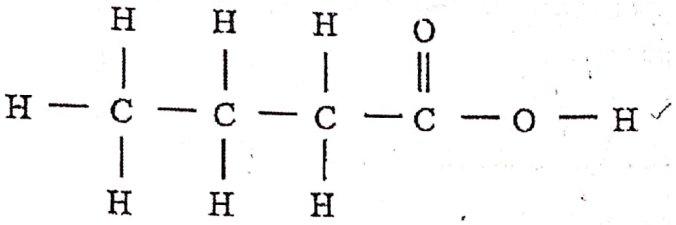
A It has a giant molecular structure.
B It has a high melting point.
C It contains delocalised electrons.
D Its atoms are in layers which slide over each other.

30 The results of chemical tests carried out on a compound, Q, are shown.

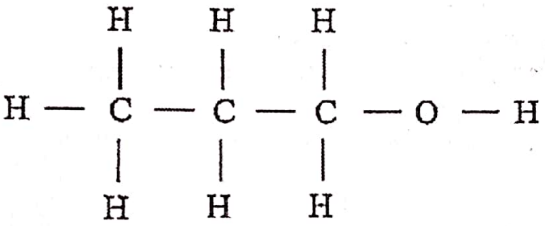
test	result
bromine water was added	colourless solution produced
aqueous sodium carbonate was added	a gas produced that turned limewater milky

What could be compound Q?

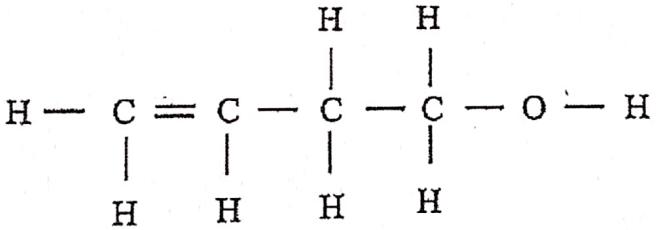
A



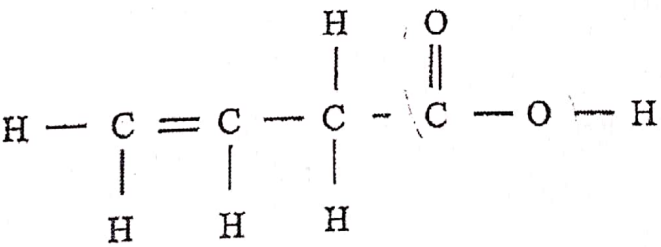
B



C



D



31 Which is **not** a property of ethane?

A high boiling point
B gas at room temperature
C insoluble in water
D a non-conductor of electricity

32 A gas, **Y**, does not decolourise bromine but burns in excess oxygen to give CO_2 and H_2O.

What could be gas **Y**?

A ethane
B ethene
C ethanoic acid
D ethylethanoate

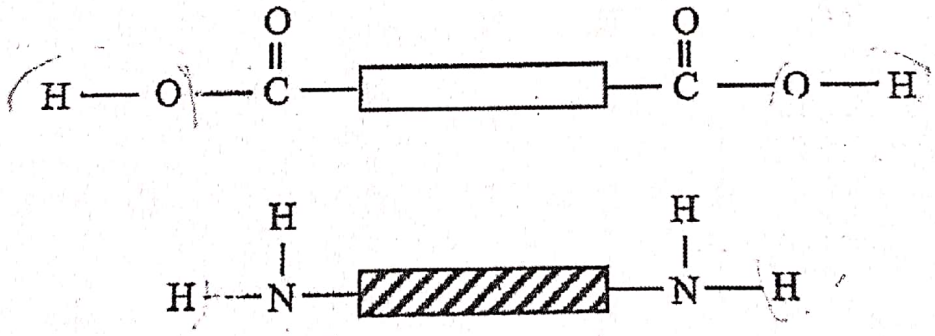
33 The equation shows how an organic compound X is produced.

$$C_2H_4 + H_2O \rightleftharpoons X$$

What is X?

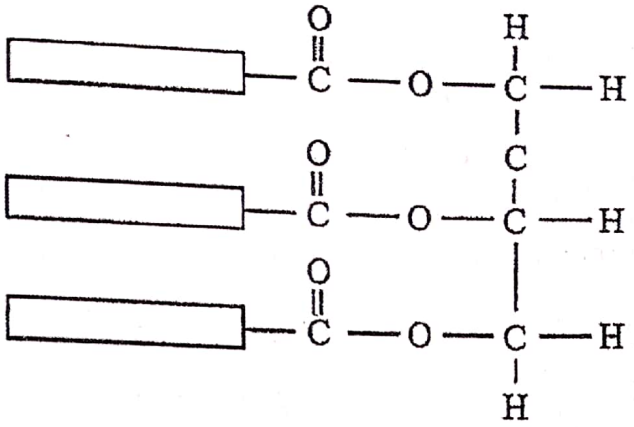
A CH_3CH_2OH
B CH_3CH_3
C CH_3CO_2H
D $CH_3CO_2CH_3$

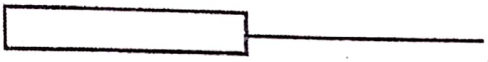
34 Which polymer is formed from the monomers shown?



A terylene
B starch
C nylon
D polythene

35 The diagram shows the structure of an organic compound.



The symbol,  , in the structure represents

A an alkyl.
B an amide.
C an ester.
D a peptide.

36 What type of reaction occurs when ethanol is converted to ethanoic acid?

A reduction
B oxidation
C condensation
D dehydration

37 Which polymer is natural?

A nylon
B poly(ethene)
C starch
D terylene

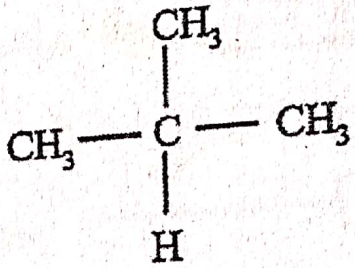
38 Which solution reacts with ethanol to produce an ester?

A aqueous ammonia
B ethanoic acid
C ethylethanoate
D hydrochloric acid

39 Which element is not present in protein molecules?

A carbon
B nitrogen
C hydrogen
D chlorine

40 The diagram shows the structure of a hydrocarbon.



The structure shown is an isomer of

A propane
B butene
C propene
D butane

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Ordinary Level

EXPECTED ANSWERS

CHEMISTRY	NOV 2016	5071/1

1	D
2	D
3	B
4	B
5	B
6	D
7	B
8	B
9	C
10	D
11	A
12	C
13	B
14	C
15	
16	C
17	C
18	D
19	A
20	B

21	C
22	A
23	B
24	C
25	B
26	A
27	D
28	C
29	D
30	D
31	C
32	A
33	A
34	C
35	A
36	B
37	C
38	B
39	D
40	D

Surname	Forename(s)	Centre Number	Candidate Number

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

5071/2

PAPER 2 Theory

NOVEMBER 2016 SESSION 1 hour 30 minutes

Additional materials:
Mathematical tables and/or Electronic calculator

Allow candidates 5 minutes to count pages

This booklet should not be punched or stapled and pages should not be removed.

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.
Write your centre & candidate number in the box on the top right corner of every page of this paper.
Check that all pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper.

Section A
Answer **all** questions.

Section B
Answer any **three** questions.
All essential working must be shown.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
The Periodic Table is provided as an insert.

This paper consists of 14 printed pages.

Section A

Answer all the questions in the spaces provided.

1 The electronic configuration of an element X is 2, 8, 3.

(a) State, with a reason,

(i) the period to which X belongs,

_____

reason _____ [2]

(ii) whether X is a metal or a non metal.

_____

reason _____ [2]

(b) X reacts with fluorine to form an ionic compound, W.

(i) Give the formula of the ion formed by X in the formation of W.

_____ [1]

(ii) Draw a 'dot' and 'cross' diagram of W.

[2]

1 (c) Explain why W

(i) does **not** conduct electricity in solid state,

_____

_____

_____ [1]

(ii) is an involatile solid at room temperature,

_____

_____

_____ [1]

(iii) readily dissolves in water.

_____

_____

_____ [1]

[Total: 10]

2 State the method of separation, giving a reason, for each of the following mixtures.

(a) A mixture of petrol, diesel and paraffin.

method _____

reason _____

_____

_____ [2]

Centre Number	Candidate Number

2 **(b)** A mixture of amino acids (lysine; glycine and glutamic acid).

method _____

reason _____

_____ [2]

(c) A mixture of solid ammonium chloride and sodium chloride.

method _____

reason _____

_____ [2]

[Total: 6]

3 **(a)** Choose, from the list, the species that matches the description:

SiO_2; CO_2; MnO_4^-; SO_2; NH_3

(i) turns damp red litmus paper blue

_____

(ii) a macromolecule

_____

(iii) produces acid rain

_____

(iv) an oxidising agent

_____ [4]

3 (b) Complete **Table 3.1** to show the bonding and uses of the given substances.

Table 3.1

substance	bonding	use
chlorine		
copper		
silicon		

[6]

[Total: 10]

4 (a) Define the term *dynamic equilibrium*.

_____

_____ [1]

(b) The chemical equation for the reaction of nitrogen and oxygen is:

$$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)} \quad \Delta H^{\theta} = +360 \text{ kJ/mol}$$

(i) State whether the reaction is endothermic or exothermic?

_____ [1]

(ii) Describe the effect of

1. cooling the reactants,

_____

_____ [1]

2. removing nitrogen monoxide, NO, from the reaction mixture.

_____

_____ [1]

4 (c) (i) State the method by which barium sulphate, an insoluble salt, is formed.

_____ [1]

(ii) State **two** substances, which react to produce barium sulphate.

1. _____

2. _____ [2]

(iii) Give the **three** steps required to obtain a pure dry sample of the salt.

step I: _____ [1]

step II: _____ [1]

step III: _____ [1]

[Total: 10]

5 (a) (i) Define the term *unsaturated hydrocarbon.*

_____

_____ [1]

(ii) Give **one** use of an unsaturated hydrocarbon.

_____ [1]

(b) Describe chemical tests, including observations, used to distinguish between

(i) CH_3CH_3 and $CH_2 = CH_2$,

_____

_____

_____ [2]

5 (b) (ii) CH_3CH_2OH and CH_3COOH.

_____

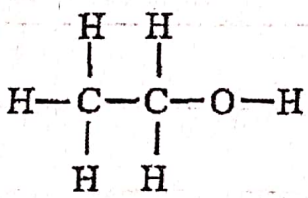
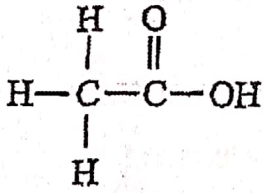
_____

_____ [2]

(c) **Table 5.1** shows some properties of two organic compounds.

Complete **Table 5.1**

Table 5.1

structural formula	homologous series	functional group
	alcohol	
		

[3]

[Total: 9]

Section B

Answer any three questions from this section in the spaces provided.

6 (a) Sodium sulphite, Na_2SO_3, reacts with hydrochloric acid to produce sodium chloride, sulphur dioxide and water. The equation for the reaction is

$$Na_2SO_3 + 2HCl \longrightarrow 2NaCl + SO_2 + H_2O.$$

(i) Write an ionic equation for the reaction.

_____

(ii) State any **one** observation made during the reaction.

_____

(iii) Describe a test for the gas evolved.

_____

_____

_____

_____

(iv) State **one** use of the gas produced.

_____ [5]

(b) Given that 12.6 g of sodium sulphite reacted completely with 20 cm^3 of hydrochloric acid.

Calculate

(i) the concentration, in $moldm^{-3}$, of the hydrochloric acid,

6 (b) (ii) volume of the gas evolved at room temperature.

[5]
[Total: 10]

7 A hydrocarbon, X, of relative molecular mass of 42 consists of 85.7% C and 14.3% H.

(a) (i) Calculate the empirical formula of X.

(ii) Deduce the molecular formula of X.

[2]

7 (b) (i) State, with a reason, the homologous series to which X belongs?

homologous series _____

reason _____

_____

[2]

(ii) Describe a test to identify X.

_____

_____ [2]

(c) Under suitable conditions, X can undergo polymerisation.

(i) State the type of polymerisation.

_____

(ii) State any **one** suitable condition for the polymerisation of X to occur

_____

(iii) Draw **one** repeat unit of the polymer.

(iv) Give **one** use of the polymer.

_____ [4]

[Total: 10]

8 (a) The reaction scheme shown in **Fig. 8.1** describes some of the reactions of Zn^{2+} and Fe^{2+} ions.

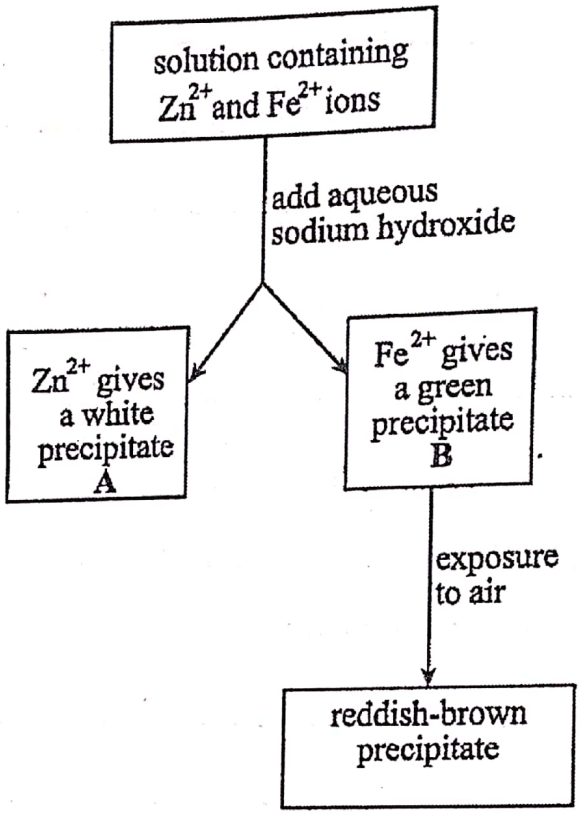


Fig. 8.1

(i) Write down the chemical formula of the

1. white precipitate **A**,

_____

2. green precipitate **B**.

_____

(ii) Name the type of reaction that forms the precipitates **A** and **B**.

_____

Centre Number	Candidate Number

8 (a) (iii) Describe with the aid of chemical equations the effect of exposing the green precipitate **B** to air.

[5]

(b) Describe what happens when

(i) a sample of calcium carbonate is heated,

(ii) copper is added to dilute hydrochloric acid,

(iii) carbon dioxide is bubbled through lime water,

(iv) water is added to white crystals of copper sulphate.

[5]
[Total: 10]

9 (a) Chlorine, bromine and iodine are Group (VII) elements.

(i) State the physical states of the three elements at room temperature.

chlorine _____

bromine _____

iodine _____

(ii) Name any **one** source of chlorine.

_____

(iii) State any **two** uses of chlorine.

1. _____

2. _____

[5]

(b) **Table 9.1** shows allotropes of carbon and some of their uses.

Table 9.1

allotrope	uses
graphite	1. lubricant 2. electrodes
diamond	1. glass cutting 2. jewellery

(i) Define the term *allotrope*.

_____

_____

Centre Number	Candidate Number

9 (b) (ii) Explain why diamond is used for

1. jewellery _____

_____

_____

2. glass cutting _____

_____

_____

(iii) Explain why graphite is used as

1. a lubricant

_____

_____

2. electrodes.

_____

_____ [5]

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

5071/2

CHEMISTRY

PAPER 2 Theory

NOVEMBER 2016 SESSION

INSERT

This insert consists of 2 printed pages.

[Turn over

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group O
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	158 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm³ at room temperature and pressure (r.t.p.)

5071/2 Insert

ZIMBABWE SCHOOL EXAMINATION COUNCIL

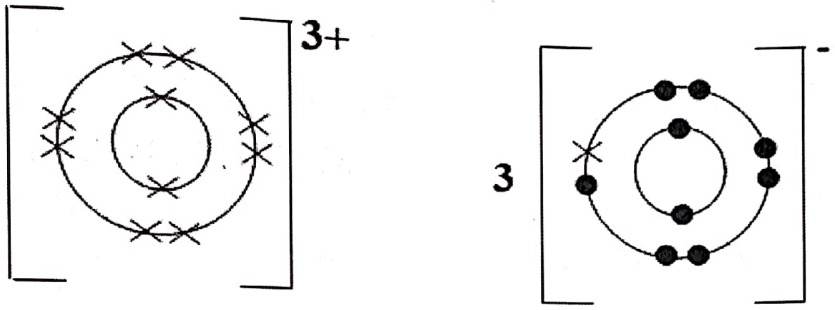
General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2016

CHEMISTRY

4024/2

1	(a)	(i)	Period 3 Has three shells
		(ii)	Metal Has a valence of (3) easier to loose three electrons than to gain five electrons to form a stable ion;
	(b)	(i)	X^{3+}/Al^{3+}
		(ii)	
	(c)	(i)	Ions are bound by strong ionic bonds/Ions are not free to move
		(ii)	Strong ionic bonds
		(iii)	W is an ionic compound
2	(a)	(i)	Fractional Distillation
		(ii)	The mixture consists of components that have different in boiling points
	(b)	(i)	Paper Chromatography
		(ii)	The components differ in their rate of solubility in solvent
	(c)	(i)	Sublimation
		(ii)	Ammonium Chloride sublimes when heated
3	(a)	(i)	NH_3
		(ii)	SiO_2
		(iii)	SO_2
		(iv)	MnO_4^-
	(b)		Chlorine: Covalent bonds Purification of water

			Copper : Metallic Bonds Electric cables/coins/Alloys Silicon: Covalent Bonds Electronics
4	(a)		State of a reversible reaction in which the rate of the forward and backward reactions are the same.
	(b)	(i)	Endothermic
		(ii) 1	Backward (exothermic) reaction is favoured
		2	Forward reaction favoured
	(c)	(i)	Precipitation/Displacement Reaction
		(ii) 1	$BaCl_2/Ba(NO_3)_2/Ba(OH)_2$
		2	H_2SO_4
		(iii)	Step 1: Precipitate Step 2:Filter Step3:Dry
5	(a)	(i)	**-A** hydrocarbon with a double bond between the carbon atoms. Not all the carbon atoms are bonded to their maximum number of four other atoms.
		(ii)	Used to make useful industrial chemicals and products e.g. -solvents (ethanol) -fuels (ethanol) -vinegar (ethanoic acid) -important plastics (polyethene)
	(b)	(i)	$CH_2 = CH_2$ react with bromine in an addition reactions and decolorizes the bromine from reddish – brown to colourless. With CH_3CH_3 only the addition reaction occurs but the bromine is not decolorized.
		(ii)	CH_3CH_2OH react with O_2 to form ethanoic acid. In the reaction acidified dichromate (VI) ions; $Cr_2O_7{}^{2-}$ (orange) are reduced to green chromium (III),$Cr^{3+}(aq)$
	(c)		$-O-H-$ Carboxylic Acid $-COOH$

6 (a) (i) $SO_3^- + 2H^+ \rightarrow SO_2 + H_2O$

(ii) Sulphur dioxide is produced with a pungent smell – like of rotten eggs.

(iii) Place a drop of acidified potassium dichromate (VI) solution on a piece of filter paper and then place it in the gas. Acidified orange potassium dichromate (VI) paper turns green.

(iv) Manufacturer of Sulphuric acid
Food preservatives
Bleaches
Paper Making

(b) (i) $Na_2SO_3 + 2HCl \rightarrow 2NACl + SO_2 + H_2O$

$n(Na_2SO_3) = \frac{12.6}{126}$

$0.1mol$

Reaction Ratio from equation is 1:2

$n(HCl) = 2 \times 0.1mol = 0.2mole$

$c(HCl) = \frac{n(HCl)}{v(HCl)} = \frac{0.2}{0.02}$

$= \mathbf{10mol/dm^3}$

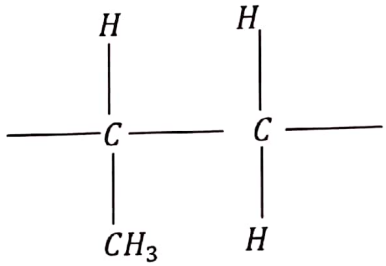
(ii) $V(SO_2) = V_M \times n(SO_2)$

$= 28 \times 0.1$

$= \mathbf{2.8dm^3}$

7 (a) (i)

Carbon (C)	Hydrogen (H)
$\frac{85.7}{12}$	$\frac{14.3}{1}$
$\frac{7.142}{7.142}$	$\frac{14.3}{7.142}$
1	**2**

			Empirical formula is CH_2
		(ii)	Let molecular formula of X be C_nH_{2n}
			$M_r(C_nH_{2n}) = 12 \times n + 2 \times n$
			$= 14n$
			$14n = 42$
			$n = 3$
			Therefore molecular formula is C_3H_6
	(b)	(i)	Alkene
			Reason: It is unsaturated/has a double $C = C$ bond
			Test : Add aqueous Bromine. The aqueous bromine is decolourized.
	(c)	(i)	Addition Polymerization
		(ii)	High Temperature High pressure Catalyst
		(iii)	
		(iv)	Plastic (bowels)/bottles/dishes/buckets
8	(a)	(i) 1	$Zn(OH)_2$
		2	$Fe(OH)_2$
		(ii)	Precipitation
		(iii)	Fe^{2+} oxidised to Fe^{3+}
			$Fe^{2+} \rightarrow Fe^{3+} + e^-$
	(b)	(i)	Decomposition to $CaO + CO_2$

		(ii)	Cu does not react
		(iii)	Lime water turns milky, white precipitate is formed CO_2 reacts to form $CaCO_3$
		(iv)	Blue colour is observed
9	(a)	(i)	Chloride: gas Bromine: liquid Iodine: Solid
		(ii)	Electrolysis of brine
		(iii)	Water treatment Bleaching Agents Manufacture of Compounds
	(b)	(i)	Different forms of the same element
		(ii)	Hard Glitters/reflects light
		(iii)	Slippery Inert Conducts electricity

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

5071/1

CHEMISTRY

PAPER 1 Multiple Choice

NOVEMBER 2017 SESSION 1 hour

Additional materials:
- Mathematical tables and/or electronic calculator
- Multiple Choice answer sheet
- Soft clean eraser
- Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D.** Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 15.

This question paper consists of 15 printed pages and 1 blank page.

[Turn over

1 Which method is **not** suitable for separating a mixture of sand and water?

A decanting
B filtration
C sieving
D winnowing

2 An example of a solid with a giant molecular structure is

A iodine.
B ice.
C silicon (IV) oxide.
D magnesium oxide.

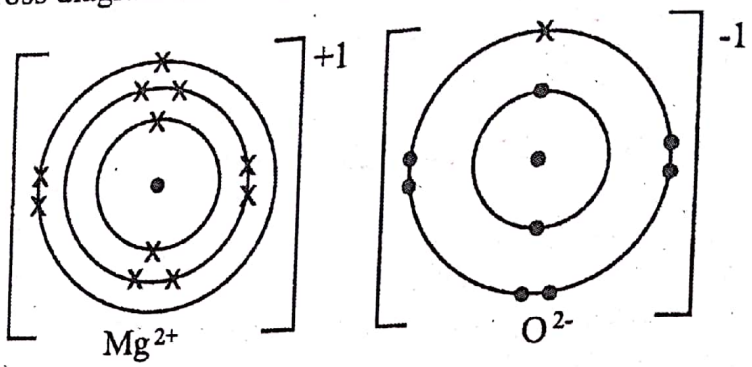
3 Which statement explains why copper wire conducts electricity?

A Copper atoms gain electrons.
B Copper atoms lose electrons.
C The "sea of electrons" can move.
D The "sea of electrons" do not move.

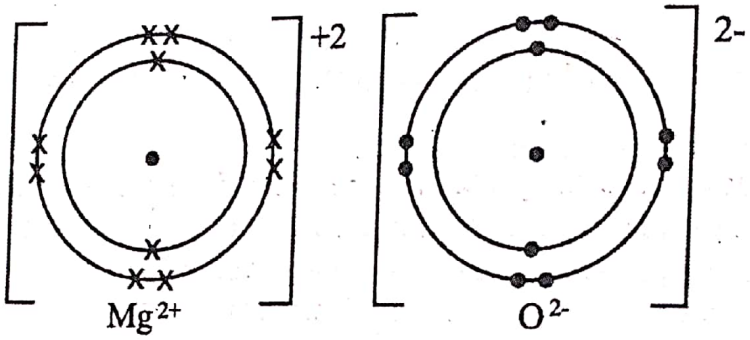
4 Magnesium reacts with oxygen to give magnesium oxide.

Which dot-and-cross diagram correctly represents the structure of magnesium oxide?

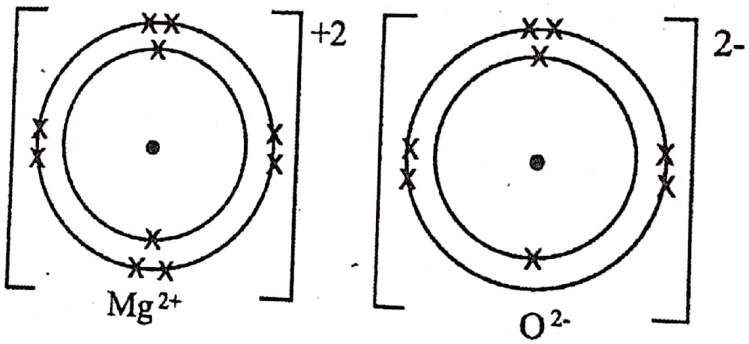
A



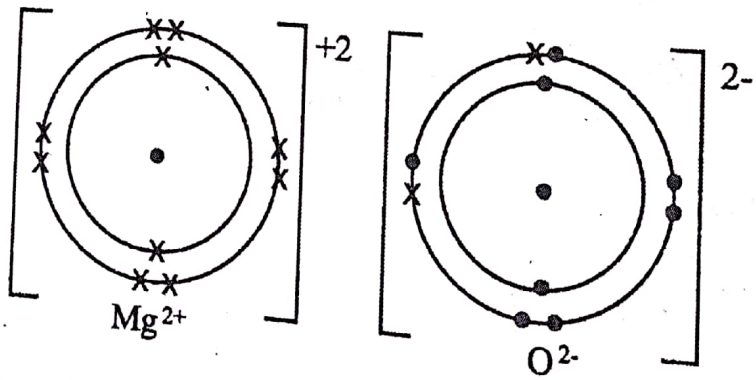
B



C



D



Key X = Mg electron
• = O electron

5 Silicon (IV) oxide is used in making ceramics because it has

A an ionic lattice structure.
B a giant molecular structure.
C a metallic structure.
D a simple molecular structure.

6 Which one is a property of the product formed between hydrogen and carbon?

A Has a high boiling point.
B Does not conduct electricity.
C There are electrostatic forces between the molecules.
D Does not involve sharing of electrons.

7 Which statement is true about isotopes of boron, $^{10}_{5}B$ and $^{4}_{5}B$?

A They have the same proton number but different mass number.
B They have the same number of electrons but different proton number.
C They have the same number of protons and neutrons.
D They have the same number of electrons and neutrons.

8 The charge on the hydroxide ion is

A +2.
B −2.
C +1.
D −1.

9 A mass of 3.9 g of an element, Z, reacted with oxygen to form 4.7 g of the oxide, Z_2O.

What could be element Z?

A sodium
B potassium
C lithium
D hydrogen

10 The equation shows a reaction that occurred when 100 cm^3 of air were passed over heated excess copper in a closed container.

$$2Cu_{(s)} + O_{2(g)} \rightarrow 2CuO_{(s)}$$

What was the new volume of air after cooling?

A 20 cm^3
B 50 cm^3
C 80 cm^3
D 100 cm^3

11 Hydrogen peroxide, H_2O_2, decomposes to form water and oxygen according to the equation.

$$2H_2O_{2(aq)} \xrightarrow{\text{catalyst}} 2H_2O_{(l)} + O_{2(g)}$$

The volume of oxygen produced at r.t.p was 60 cm^3.

[1 mole of gas at r.t.p. has a volume of 28 dm^3]

What volume of hydrogen peroxide was used?

A 30 cm^3
B 60 cm^3
C 120 cm^3
D 1 200 cm^3

12 A volume of 20 cm^3 of 0.25 mol/dm^3 sodium hydroxide reacted completely with 25 cm^3 of nitric acid. The chemical equation for the reaction is

$$NaOH_{(aq)} + HNO_{3(aq)} \rightarrow NaNO_{3(aq)} + H_2O_{(l)}$$

What was the concentration of the acid?

A 0.2 mol/dm^3
B 0.25 mol/dm^3
C 12.6 mol/dm^3
D 0.315 mol/dm^3

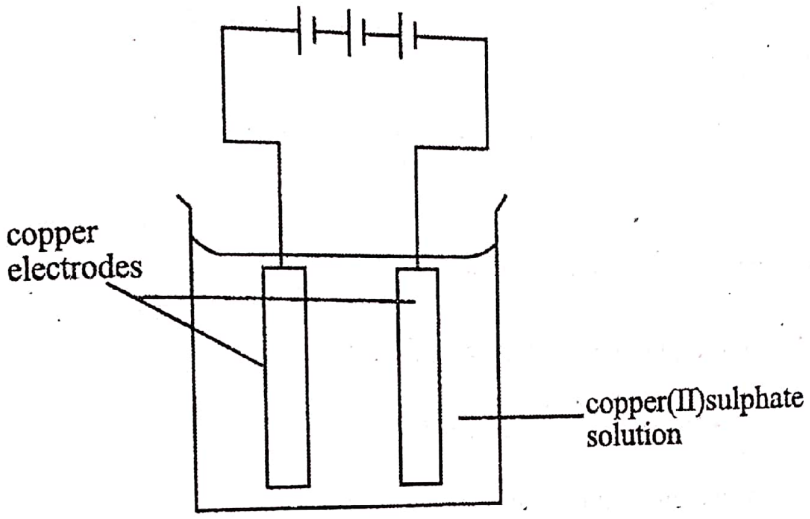
13 $NaOH_{(aq)}$ reacts with $N_2O_{4(g)}$ according to the equation:

$$N_2O_{4(g)} + 2NaOH_{(aq)} \rightarrow NaNO_{3(aq)} + H_2O_{(l)} + NO_{2(g)}$$

What volume of 1.0 mol/dm^3 $NaOH_{(aq)}$ is required to absorb 0.04 mol of N_2O_4?

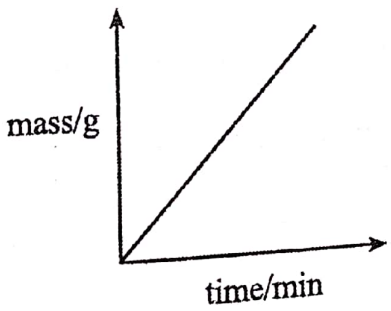
A 80 cm^3
B 40 cm^3
C 20 cm^3
D 0.08 cm^3

14 The diagram shows the electrolysis of copper (II) sulphate solution using copper electrodes.

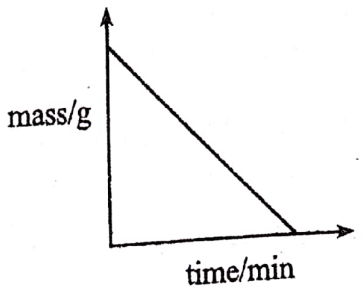


Which graph correctly shows the change in mass of the anode with time?

A



B



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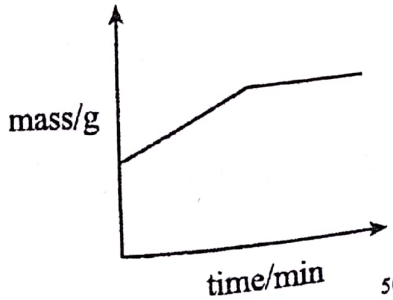

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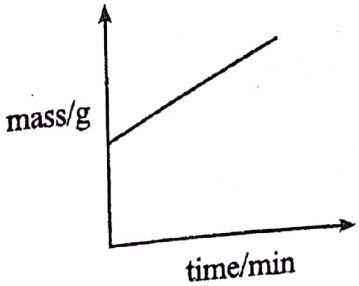


15 Organic waste decomposes in water to form an acidic solution.

Which compound can be used to neutralise the acidic solution?

A calcium hydroxide
B calcium chloride
C potassium nitrate
D potassium sulphate

16 Which one is **not** a product of the electrolysis of brine?

A chlorine
B hydrogen
C oxygen
D sodium hydroxide

17 Powdered calcium reacts with sulphuric acid as shown by the equation.

$$Ca_{(s)} + H_2SO_{4(aq)} \rightarrow CaSO_{4(aq)} + H_{2(g)}$$

The speed of the reaction can be increased by

A using granules of calcium.
B adding dilute sulphuric acid.
C warming the mixture.
D adding less powdered calcium.

18 Vanadium (V) oxide is used in the Contact Process for the formation of sulphur trioxide.

What is the effect of the vanadium (V) oxide on the reaction?

A increases the yield of sulphur trioxide
B increases the kinetic energy of the reactants
C speed up the rate of the forward reaction
D lowers the speed of the reverse reaction

19 Which one is a redox reaction?

A $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$
B $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$
C $Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(s)}$
D $Al_2Cl_{6(g)} \rightarrow 2AlCl_{3(g)}$

[Turn over

20 Which statement is correct about **all** acids?

A They contain hydrogen and oxygen only.
B They react with oxides to form a salt and hydrogen.
C They react with some metals to produce hydrogen.
D They can be electrolysed to produce hydrogen.

21 Which pair consists of amphoteric oxides only?

A SO_3 and CO_2
B ZnO and MgO
C Al_2O_3 and MgO
D ZnO and Al_2O_3

22 A white precipitate was obtained when acidified barium nitrate was added to a solution.

The ion present in the solution could be

A Al^{3+}
B Cl^-
C Zn^{2+}
D SO_4^{2-}

23 What can be deduced from the symbol ${}^{14}_{7}Z$?

A The element is in Group (VII).
B The element forms an ion of charge –1.
C The element has an ion of charge –3.
D The element has an ion of charge +3.

24 Which element is a metal?

A berylium
B boron
C phosphorous
D sulphur

25 Which element shows the same oxidation number in its compounds?

A chlorine
B nitrogen
C magnesium
D sulphur

26 An aqueous solution containing potassium bromide produces bromine when treated with substance Z.

What could be substance Z?

A potassium chloride
B potassium iodide
C chlorine gas
D iodine

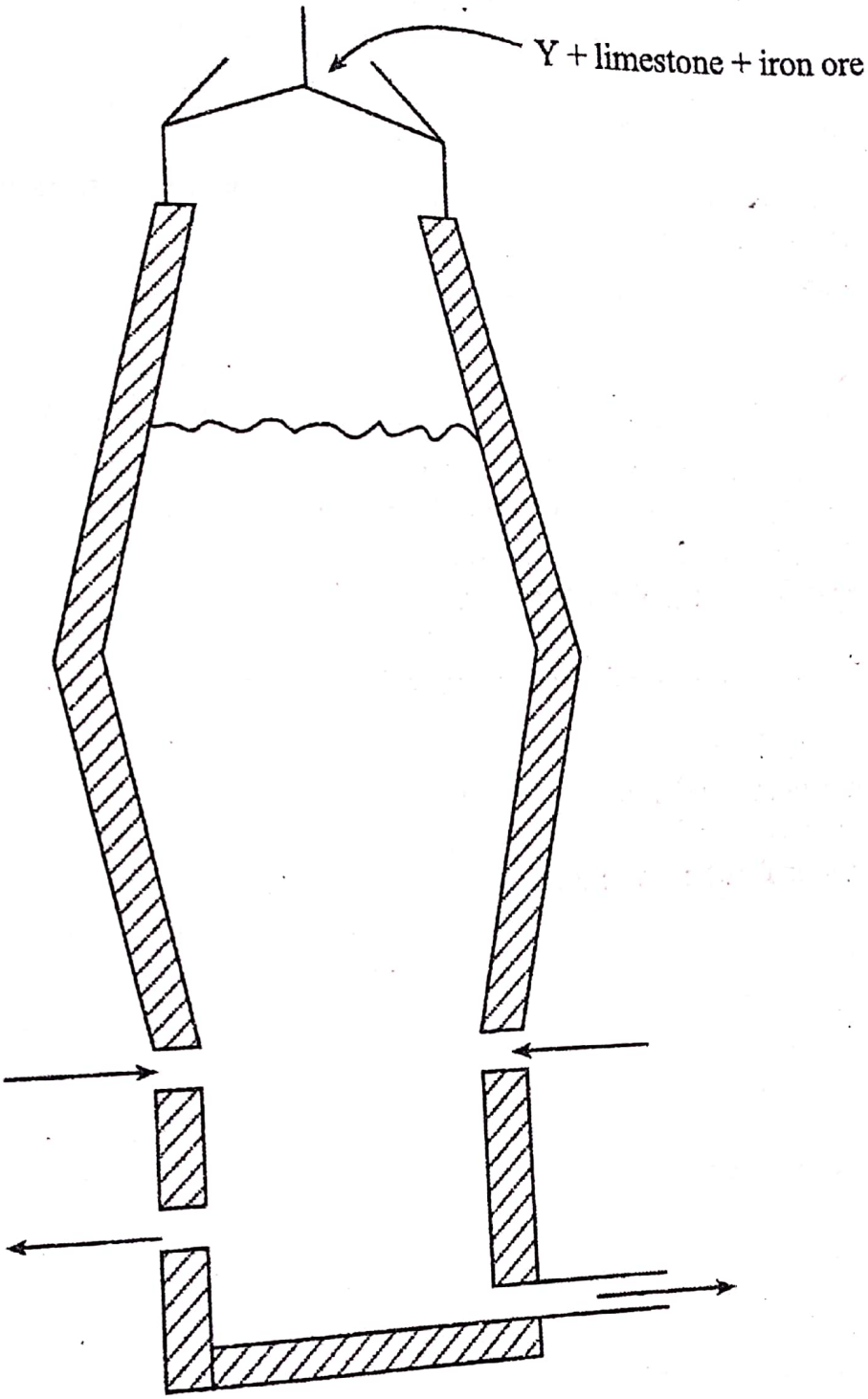
27 An example of an endothermic reaction is when

A sulphuric acid reacts with sodium hydroxide.
B magnesium displaces copper (II) ions in aqueous solution.
C ammonium nitrate dissolves in water.
D sodium hydroxide dissolves in water.

28 The products of decomposition of magnesium carbonate by heating are

A magnesium and carbon.
B magnesium oxide and carbon dioxide.
C magnesium oxide and carbon monoxide.
D magnesium and carbon dioxide.

29 The diagram shows the Blast Furnace for the extraction of iron.



What is Y?

A coke
B calcium silicate
C silica
D pig iron

30 A gas present in car exhaust fumes in large amounts is

A nitrogen
B carbon dioxide
C carbon monoxide
D water vapour

31 Why is aluminium oxide dissolved in molten cryolite in the extraction of aluminium?

A to lower the melting point of bauxite
B to prevent the reaction of electrodes with aluminium
C cryolite increases electrical conductivity of molten bauxite
D aluminium oxide forms a protective layer and becomes unreactive

32 Which set of conditions would give an increase in the yield of ammonia?

	temperature	**pressure**
A	high	high
B	low	low
C	low	high
D	high	low

33 Which is **not** a use of sulphur dioxide?

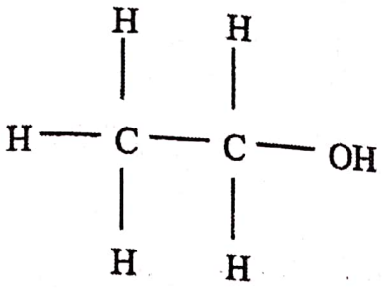
A bleaching agent
B paper manufacture
C food preservation
D neutralising acids

34 Which compound is an alkane?

A $CH_3CO_2CH_3$
B C_2H_5OH
C C_8H_{18}
D C_6H_{12}

35 Which compound decolourises aqueous bromine?

A



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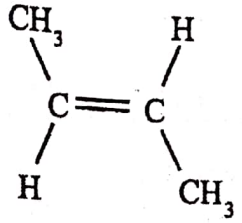

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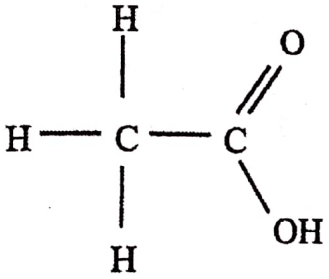

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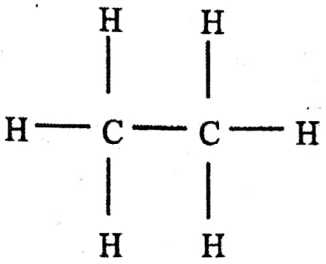
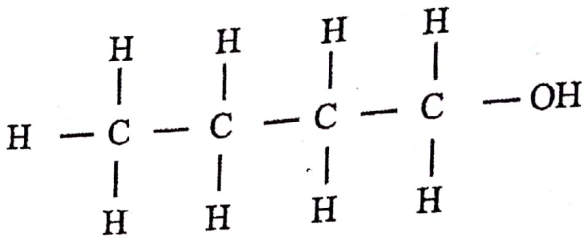


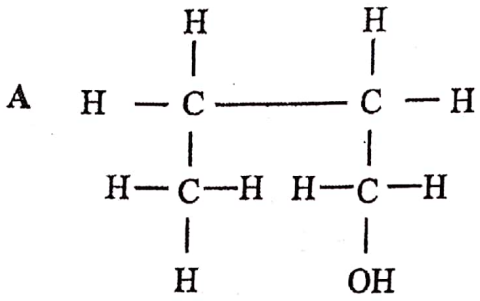
36 Which compound can be oxidised to produce ethanoic acid?

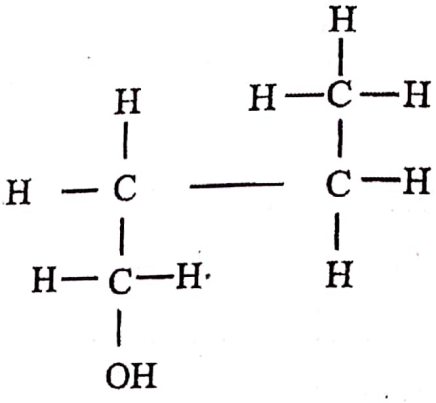
A CH_3CH_3
B $CH_3CH_2CH_3$
C CH_3CH_2OH
D $CH_3CH_2CH_2CH_2OH$

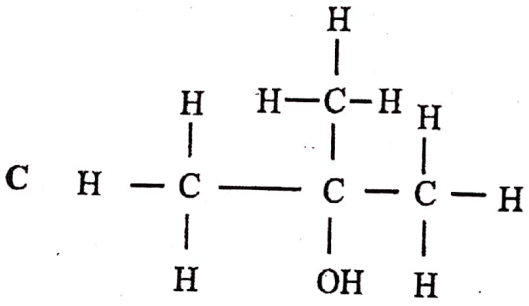
37 The structural formula of butanol is shown.

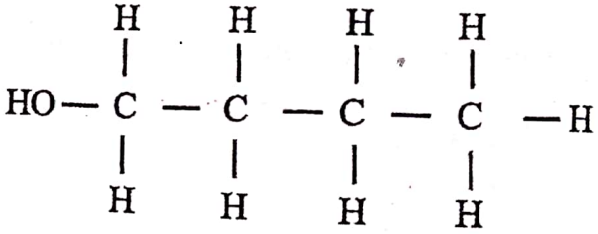


Which substance is an isomer of butanol?

A 

B 

C 

D 

38 Which substance can be used to distinguish between ethanol, CH_3CH_2OH and ethanoic acid, CH_3CO_2H?

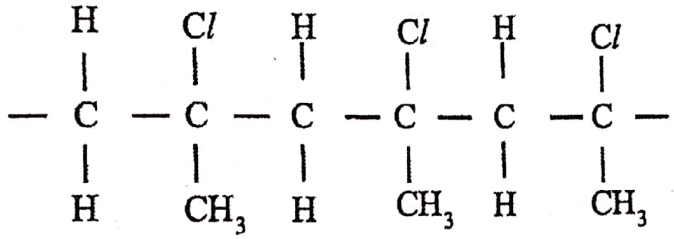
A glowing splint
B bromine water
C sulphuric acid
D blue litmus paper

39 A substance, X, reacts with its own oxidation product to give an ester.

X could be

A butane.
B butene.
C butanol.
D butanoic acid.

40 Part of a polymer is given as:



Which formula shows its correct monomer?

A C_2H_3Cl
B C_2H_5Cl
C C_3H_5Cl
D C_3H_3Cl

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EXPECTED ANSWERS

CHEMISTRY	NOV 2017	5071/1

1	D
2	C
3	C
4	D
5	B
6	B
7	A
8	D
9	B
10	D
11	C
12	B
13	B
14	B
15	D
16	C
17	C
18	A
19	A
20	B

21	D
22	D
23	A
24	A
25	A
26	A
27	C
28	B
29	A
30	B
31	D
32	A
33	B
34	C
35	D
36	A
37	C
38	D
39	C
40	C

Surname | Forename(s) | | Candidate Number

For Performance Measurement

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CHEMISTRY 5071/2

PAPER 2 Theory

NOVEMBER 2017 SESSION 1 hour 30 minutes

Candidates answer on the question paper.

Additional materials:

Mathematical tables and/or Electronic calculator

Allow candidates 5 minutes to count pages

This booklet should not be punched or stapled and pages should not be removed.

The Periodic Table which is provided as an insert should be retained by the centre.

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.
Write your centre and candidate number in the box on the top right corner of every page of this paper.
Check that all pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper.

Section A

Answer **all** questions.

Section B

Answer any **three** questions.
All essential working must be shown.

INFORMATION FOR CANDIDATES

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

This paper consists of 16 printed pages and an insert.

[Turn over

Candidate Number

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General Certificate of Education Ordinary Level

CHEMISTRY 5071/2

PAPER 2 Theory

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Answer **all** questions.

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Answer any **three** questions.
All essential working must be shown.

INFORMATION FOR CANDIDATES

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This paper consists of 16 printed pages and an insert.

[Turn over

Centre Number	Candidate Number

Section A

*Answer **all** the questions in the spaces provided.*

1 (a) **Fig. 1.1** shows an experiment that was used to demonstrate diffusion.

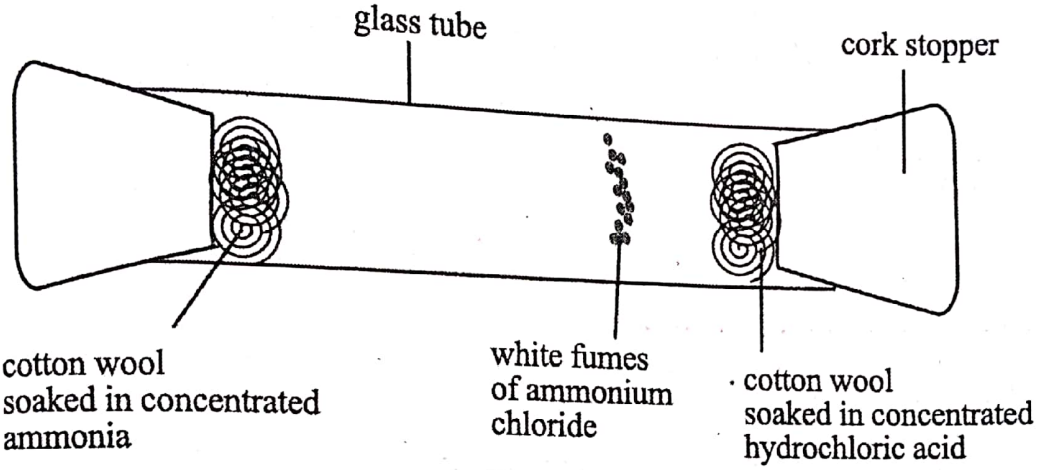


Fig. 1.1

(i) Define the term *diffusion.*

_____

_____ [1]

(ii) Explain why the white fumes were formed at the centre of the glass tube.

_____

_____ [2]

(iii) Write a balanced chemical equation for the reaction that produces the white fumes.

_____ [2]

(b) (i) Name the method that can be used to

1. obtain pure water from sea water,

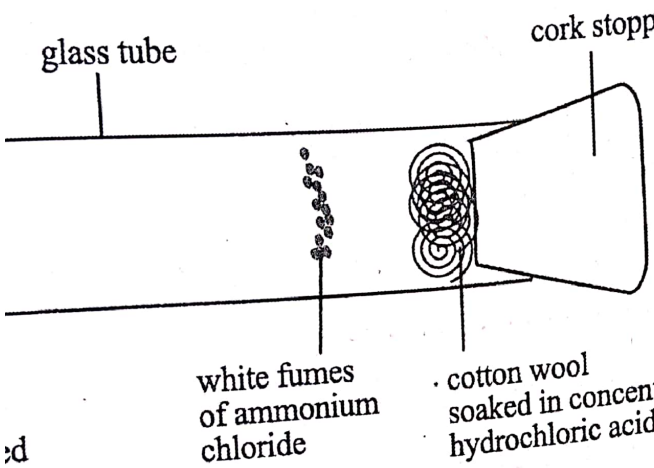
_____ [1]

Centre Number	Candidate Number

Section A

ll the questions in the spaces provided.

:xperiment that was used to demonstrate diffusion.



:d

Fig. 1.1

ıe term *diffusion*.

[1]

why the white fumes were formed at the centre of the ıbe.

[2]

a balanced chemical equation for the reaction that produces ıite fu

[2]

ethod that can be used to obtain pure water from sea water,

[1]

1 (b) (i) 2. separate amino acids in a mixture.

_____ [1]

(ii) Explain why foodstuffs should be pure.

_____

_____ [1]

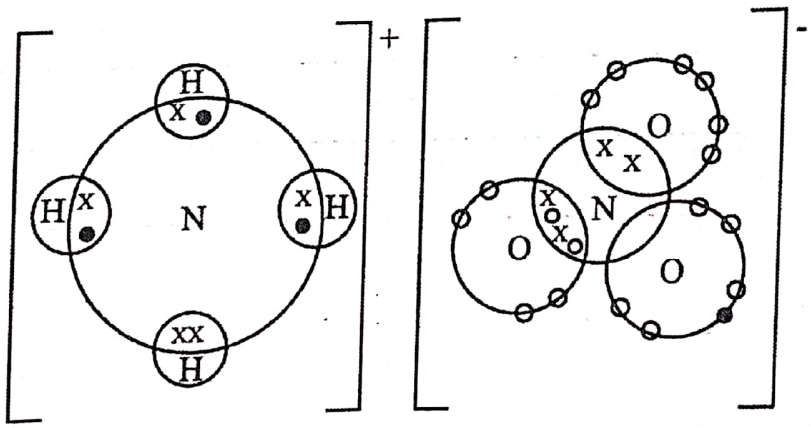
(iii) Describe and explain how a pure liquid can be identified.

_____

_____ [2]

[Total:10]

2 (a) **Fig. 2.1** shows bonding in ammonium nitrate. Valence shells only are shown.



Key x - Nitrogen electron
o - Oxygen electron
● -Hydrogen electron

Fig. 2.1

(i) Label, on the diagram, a double bond. [1]

Centre Number	Candidate Number

(a) (ii) Write the formula of ammonium nitrate.

_____ [1]

(iii) Define the term *valence*.

_____

_____ [1]

(iv) Name the type of bonding shown between

1. nitrogen and oxygen,

_____

2. ammonium ion and the nitrate ion.

_____ [2]

(b) State any **three** physical properties of ammonium nitrate.

1. _____
2. _____
3. _____ [3]

[Total: 8]

3 (a) **Fig. 3.1** shows the electrolysis of a concentrated solution of sodium chloride.

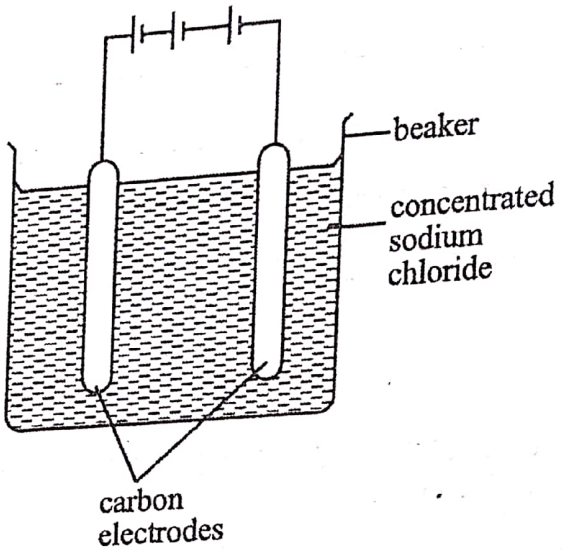


Fig. 3.1

(i) Label, on the diagram, the anode. [1]

(ii) State the observation made at the cathode.

_____

_____ [1]

(iii) Describe and explain what happens when blue litmus paper is placed near the anode.

_____

_____ [1]

(iv) Explain why red litmus paper turned blue when it was placed near the cathode.

_____

_____

_____

_____ [2]

[Turn over

(b) (i) Define the term

1. *mole*,

2. *concentration*.

[2]

(ii) A mass of 20.0 g of nitric acid, HNO_3, was dissolved in 200 cm^3 of distilled water.

Calculate the concentration of the resulting solution.

[2]
[Total: 9]

4 (a) Fizzy drinks are made by dissolving carbon dioxide under pressure and tightly closing the bottle. The reactions that occur are as shown in equations 1 and 2.

1. $CO_{2(g)} \rightleftharpoons CO_{2(aq)}$

2. $CO_{2(aq)} + H_2O_{(l)} \rightarrow H_2CO_{3(aq)}$

(i) State the meaning of the symbol $\rightleftharpoons$ in equation 1.

[1]

(ii) Deduce and explain the effect of carbon dioxide on the pH of the drinks.

[1]

(b) Nitrogen can be produced from ammonium salts as shown in Fig. 4.1.

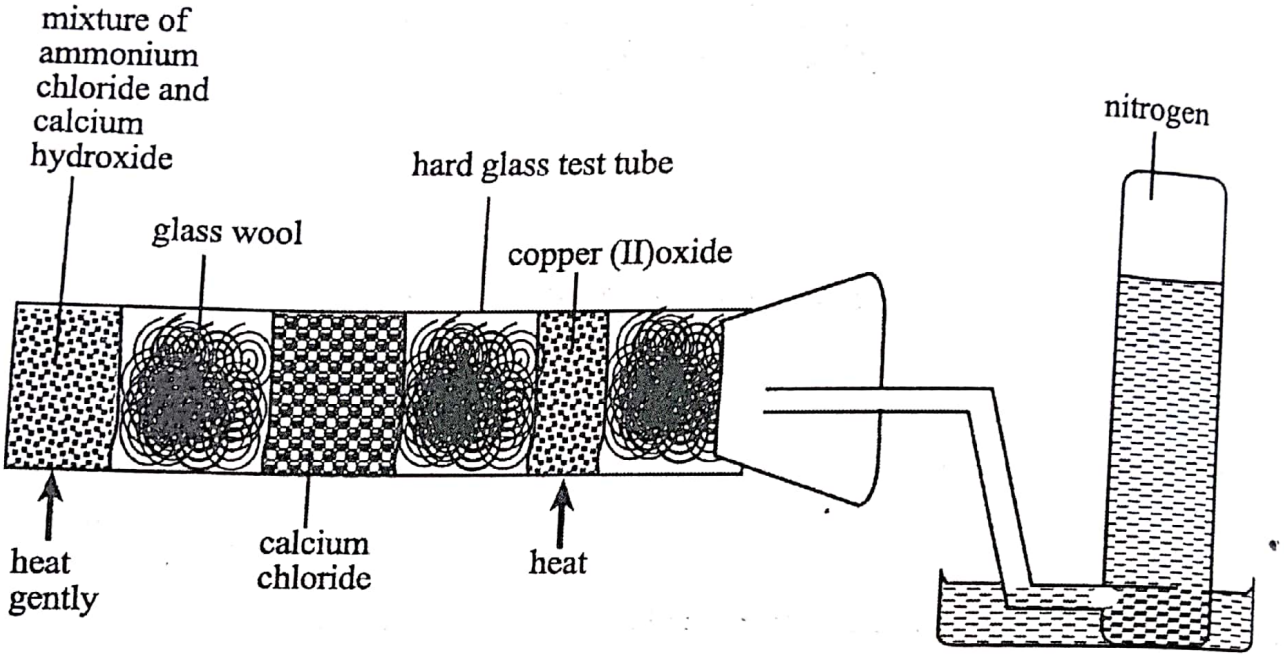


Fig. 4.1

Ammonium chloride reacted with calcium hydroxide to produce ammonia.

The ammonia was oxidised by copper (II) oxide to produce nitrogen, copper and water.

(i) State the role of calcium chloride.

_____ [1]

(ii) State the change in the oxidation state of nitrogen.

_____ [1]

(iii) Give one industrial use of nitrogen.

_____ [1]

(b) (iv) Write a balanced chemical equation for the reaction that occurs

1. when a mixture of ammonium chloride and calcium hydroxide is heated,

[2]

2. between copper (II) oxide and ammonia.

[2]

[Total: 9]

5 (a) **Fig. 5.1** shows the structure of an organic compound, A.

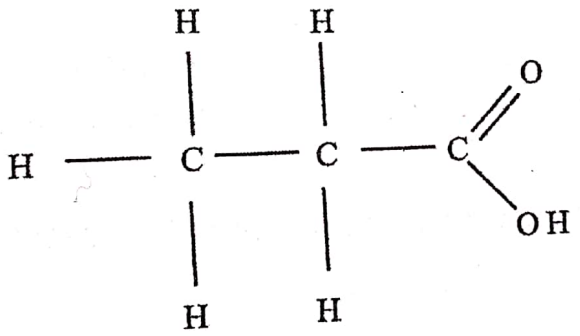


Fig. 5.1

(i) Name compound A.

[1]

(ii) Give the structural formula of an alcohol that is oxidised to produce compound A.

[1]

5 (a) (iii) Name the reagent needed to convert the alcohol to **A**.

_____

_____ [1]

(iv) Name the type of reaction that occurs when compound **A** reacts with sodium carbonate.

_____ [1]

(v) Write a balanced equation for the reaction in **(iv)**.

[2]

(b) Compound **A** is an important ingredient in animal feeds.

Suggest why compound **A** is suitable for this use.

_____

_____

_____

_____

_____

_____ [3]

[Total: 9]

Section B

*Answer any **three** questions from this section in the spaces provided.*

(a) **Table 6.1** shows results of tests carried out on water flowing out of a fertiliser producing industrial plant.

Table 6.1

tests	observations
1. to a portion of the waste sodium carbonate was added	bubbles of gas that turned lime water milky
2. to a portion of the waste aqueous sodium hydroxide was added, followed by aluminium foil and warming	white precipitate soluble in excess ammonia gas produced which turned damp red litmus paper blue
3. to a portion of the waste aqueous ammonia was added until in excess	white precipitate soluble in excess

(i) State the deductions that can be made from each test.

test 1 _____

_____

test 2 _____

_____

test 3 _____

_____ [4]

(ii) Ammonium ions, NH_4^+, were also present in the waste.

1. Describe a chemical test that confirms presence of NH_4^+ ions.

_____

6 (a) (ii) 2. State the observation made from the test?

_____

_____

[3]

(b) (i) Name **one** of the fertilisers produced in this industrial plant.

_____

(ii) Suggest **one** environmental problem the waste from the plant is likely to cause.

_____

_____

[2]

(c) Limewater is aqueous calcium hydroxide.

Write a balanced chemical equation for the reaction between lime water and carbon dioxide.

_____

_____ [1]

[Total: 10]

7 **Table 7.1** shows volumes of gas collected per minute when 5.0 g samples of powdered magnesium and powdered iron were separately reacted with equal volumes of 1.0 moldm $^{-3}$ hydrochloric acid. The reactions were carried out at the same temperature.

Table 7.1

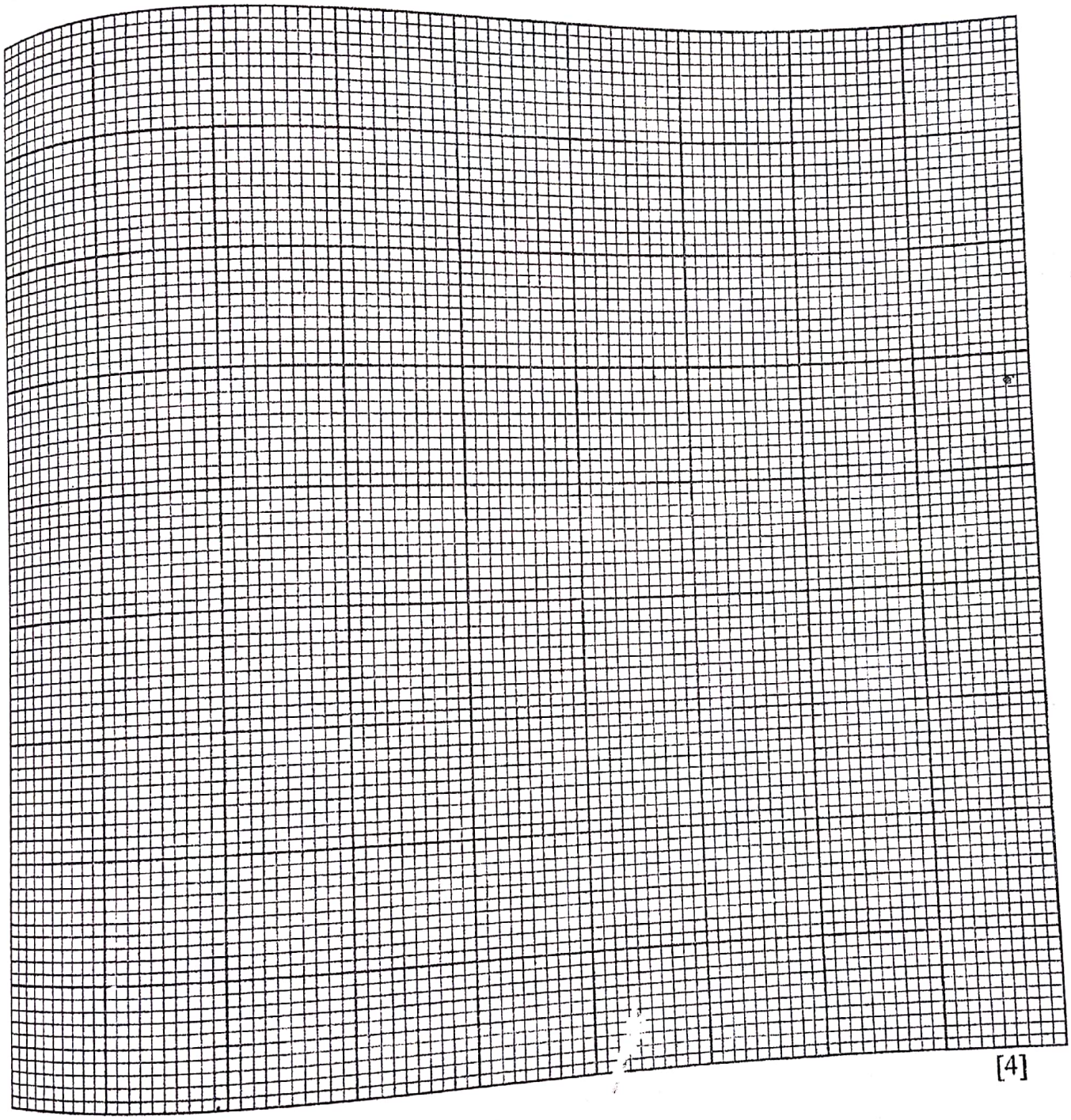
time/minutes	0	1	2	3	4	5	6	7	8
volume of gas produced by magnesium/cm^3	0	20	30	65.5	39.5	40	40	40	40
volume of gas produced by iron/cm^3	0	6	11	17	13	29	33.5	37	40

(a) Name the gas produced when the metals reacted with hydrochloric acid.

_____ [1]

[Turn over

(b) Plot, on the same axes, graphs of volume, *y*-axis, against time, *x*-axis, for the two metals.



[4]

(c) Compare the relative reactivities of the two metals.

[1]

7 (d) (i) On the same axes, draw a sketch of the graph of the expected results for 5.0 g of powdered zinc under similar conditions. [1]

(ii) Explain the position of the graph in **(d)(i)**.

_____

_____

_____ [1]

(e) Using the same amounts of reagents, state any **two** conditions that will result in an increase in the rate of gas production.

1. _____

2. _____

[2]

[Total: 10]

8 (a) (i) Give any **two** advantages of using alloys.

_____

_____ [2]

(ii) State the composition of brass.

_____

_____ [2]

(iii) Give any **one** use of brass.

_____ [1]

(b) A 1.00 g sample of an alloy of iron was dissolved in dilute sulphuric acid. The resultant solution was titrated with 0.1 mol dm^{-3} aqueous potassium dichromate. A volume of 18.00 cm^3 of potassium dichromate was needed to reach end point.

(i) Write a balanced equation for the reaction of iron with dilute sulphuric acid.

_____

_____ [1]

(ii) Calculate the number of moles of potassium dichromate used.

[2]

(iii) The titration reaction is as shown:

$$6Fe^{2+}_{(aq)} + Cr_2O^{2-}_{7(aq)} + 14H^{+}_{(aq)} \rightarrow 6Fe^{3+}_{(aq)} + 2Cr^{3+}_{(aq)} + 7H_2O_{(l)}$$

Deduce the number of moles of iron in the 1.00 g sample of the alloy.

_____

_____ [1]

(iv) Calculate the mass of iron in the alloy sample [A:Fe = 56].

[1]
[Total: 10]

9 (a) (i) Define the term *isomer*.

_____

_____ [1]

(ii) Draw **three** isomers with the formula C_5H_{12}.

[3]

(b) The reaction scheme shown in **Fig. 9.1** shows some of the reactions of ethene.

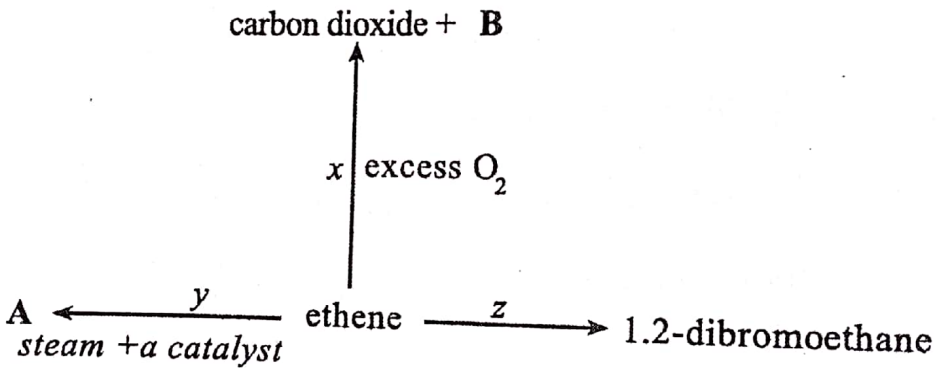


Fig. 9.1

(i) Identify products **A** and **B**.

A _____

B _____ [2]

(ii) Name

1. reaction *x*,

_____ [1]

Centre Number	Candidate Number

(b) (ii) 2. the reagent used in reaction *z*.

_____

_____

[1]

(iii) Draw the structural formula of 1, 2-dibromoethane.

[2]
[Total: 10]

[redacted]

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General Certificate of Education Ordinary Level

5071/2

CHEMISTRY

PAPER 2 Theory

NOVEMBER 2017 SESSION 1 hour 30 minutes

INSERT

This insert consists of 2 printed pages.

[Turn over

DATA SHEET
The Periodic Table of the Elements

Group	I	II	III	IV	V	VI	VII	O
								4 He Helium 2
	7 Li Lithium 3	9 Be Beryllium 4						
	23 Na Sodium 11	24 Mg Magnesium 12						
	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26
	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44
	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76
	226 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †					

								1 H Hydrogen 1								
									11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30						70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48						115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80						204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm³ at room temperature and pressure (r.t.p.)

2 INSERT

INSERT N2017

ZIMBABWE SCHOOL EXAMINATION COUNCIL

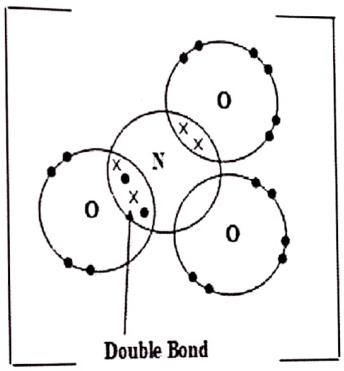
General Certificate of Education Ordinary Level

EXPECTED ANSWERS

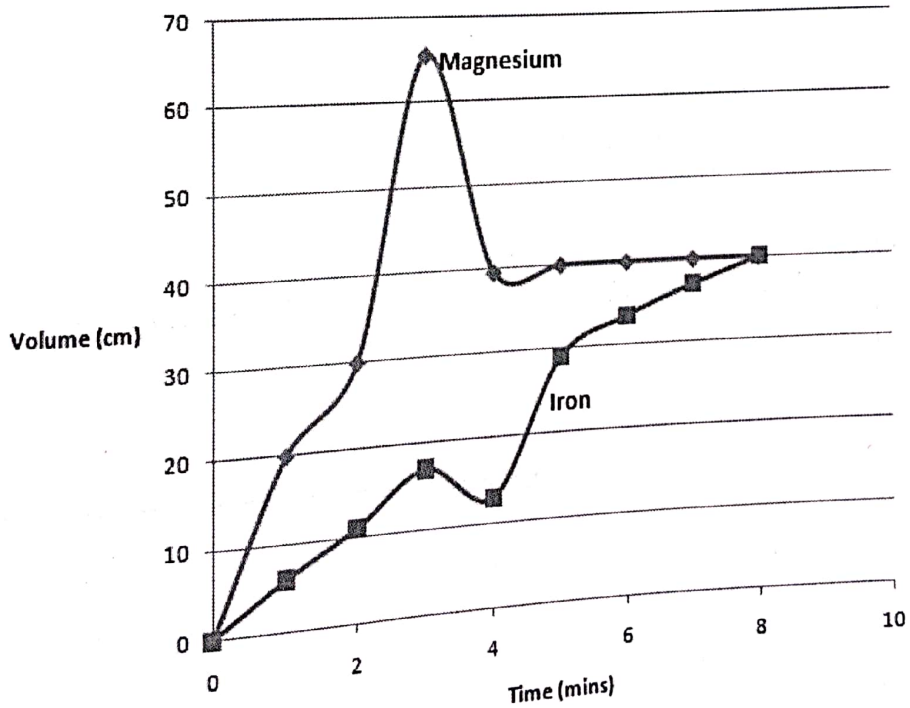
NOVEMBER 2017

CHEMISTRY

4024/2

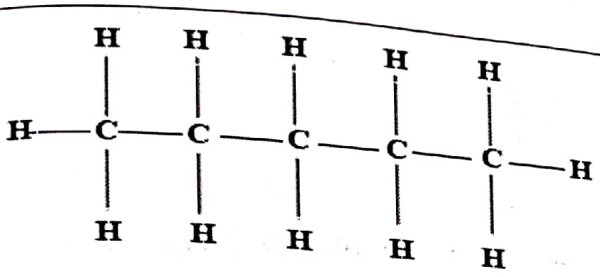
1	(a)	(i)	Movement of particles from their region of higher concentration to the region of low concentration.
		(ii)	HCl has a higher molecular mass of 36.5 than that of Ammonia which is 17. Hence HCl diffuses slower as compared to Ammonia.
		(iii)	$NH_3 + HCl \rightarrow NH_4Cl$
	(b)	(i) 1	Simple Distillation
		2	Paper Chromatography
		(ii)	-Impurities can poison the food -impurities can affect the flavour of the food. -Impurities can cause the food to quickly go bad.
		(iii)	A pure liquid has a constant boiling point and constant melting point
2	(a)	(i)	
		(ii)	NH_4NO_3
		(iii)	The number of electrons an atom needs to gain/share/lose in order to attain a noble gas electronic structure.
		(iv) 1	Covalent Bonding
		2	Ionic Bonding
	(b)		Soluble in water Conducts electricity in molten or solution form Solid at room temperature and pressure Brittle and hard High melting and high boiling point

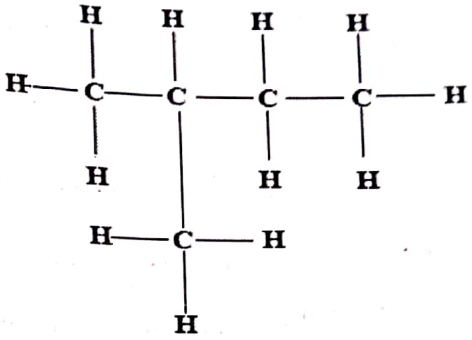
3	(a)	(i)	Left electrode is the anode
		(ii)	Gas bubbles
		(iii)	Becomes bleached/turns white and lose its original color
		(iv)	Na^+ and OH^- are left in the solution forming $NaOH$ which is alkaline and it turns red litmus paper to blue.
	(b)	(i) 1	A mole is the amount of substance that contains the same number of units as the number carbon atoms in 12 grams of carbon-12 .
		2	Concentration of a solution is the amount of solute in moles dissolved in $1dm^3$
		(ii)	$concentration = \frac{moles}{volume}$ $concentration = \frac{20}{60} \times \frac{1000}{200}$ $= 1.59mol/dm^3$
4	(a)	(i)	Reversible reaction
		(ii)	Reduces the PH to less than 7 (Acidic PH).
	(b)	(i)	Drying Agent (It absorbs water)
		(ii)	From 3 to 0
		(iii)	Manufacture of fertilisers Manufacture of Nitric Acid
		(iv) 1	$Ca(OH)_{2(aq)} + 2NH_4Cl_{(s)} \rightarrow 2NH_{3(g)} + 2H_2O_{(l)} + CaCl_{2(aq)}$
		2	$3CuO_{(s)} + 2NH_{3(g)} \rightarrow 3Cu_{(s)} + 3H_2O_{(l)} + N_{2(g)}$
5	(a)	(i)	Propanoic Acid
		(ii)	$CH_3CH_2CH_2OH$
		(iii)	Potassium Dichromate (Atmospheric Oxygen)
		(iv)	Neutralisation/ Acid Base Reaction

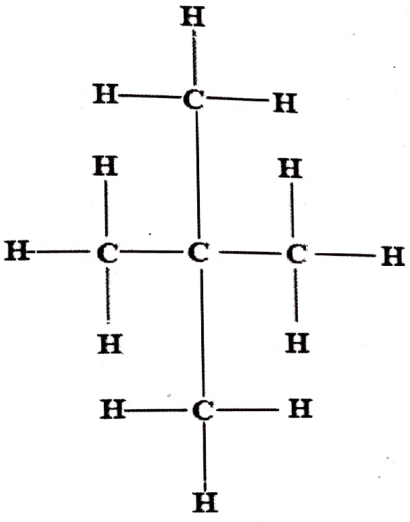
		(v)	$2CH_3CH_2COOH + Na_2CO_3 \rightarrow 2CH_3CH_2COONa + CO_2 + H_2O$
	(b)		-It is acidic i.e. it has a low PH -Bacteria does not survive under acidic conditions -Low PH of compound A therefore prevents the growth/survival of the pathogens that can affect the animals
6	(a)	(i)	Test1: Acid/H^+ Test2: $Pb^+/Al^{3+}/NO_3^-/NO^{2-}$ Test3: Zn^{2+}
		(ii) 1	Add an alkali; heat/warm
		2	Ammonia gas which turns damp red litmus paper to blue is produced.
	(b)	(i)	Ammonium Nitrate Fertilizer
		(ii)	Acidic soils/Death of plants/Death of water organisms
	(c)		$Ca(OH)_2 + CO \rightarrow CaCO_3 + H_2O$
7	(a)		Hydrogen
	(b)		

	(c)		Magnesium is more reactive than Iron
	(d)	**(i)**	Draw Line in between the two graphs
		(ii)	Zinc is more reactive than iron but less reactive than Magnesium
	(e)		**1.** Increasing Temperature/Heating **2.** Increasing Concentration of Acid
8	**(a)**	**(i)**	-They give high mechanically strong metals -They produce corrosion resistant metals -Harder metals produced
		(ii)	Copper and Zinc
		(iii)	-Making water tap joints for water pipes -Making musical instruments
	(b)	**(i)**	$Fe_{(s)} + H_2SO_{4(aq)} \rightarrow FeSO_{4(aq)} + H_{2(aq)}$
		(ii)	$n(Cr_2O_7^{2-}) = \frac{18}{1000} \times 0.1$ $= \mathbf{0.0018moles}$
		(iii)	$n(Fe^{2+}) = 6 \times 0.0018$ $= \mathbf{0.0108moles}$
		(iv)	$m(Fe^{2+}) = n(Fe^{2+}) \times M_r(Fe^{2+})$ $= 0.0108 \times 56$ $= \mathbf{0.605g}$
9	**(a)**	**(i)**	Isomers are compounds with the same molecular formula but different structural formula

(ii)







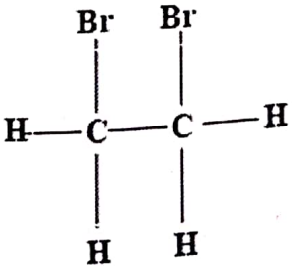
(b) (i) **A** Ethanol/C_2H_5OH

B Water

(ii) **1.** Oxidation/Combustion

2. Bromine Water/Bromine

(iii)



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

4024/1

PAPER 1 Multiple Choice

NOVEMBER 2018 SESSION

1 hour

Additional materials:
Electronic calculator
Multiple Choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are forty questions in this paper. Answer **all** questions. For each question, there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.
Read very carefully the instructions on the answer sheet.

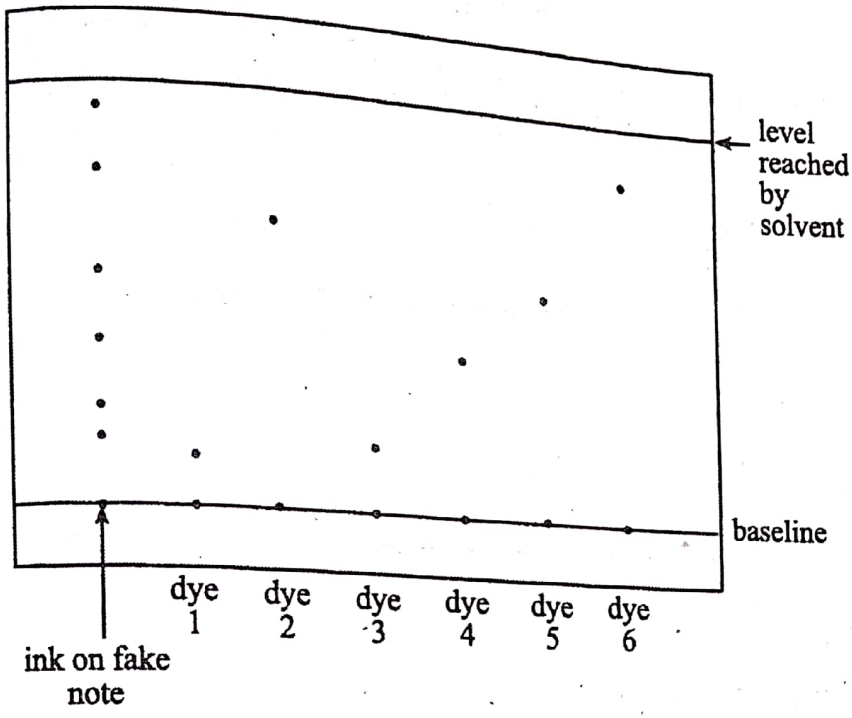
INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 12.

This question paper consists of 12 printed pages.

[Turn over

1 An investigation to identify the ink used to make a fake one hundred dollar note using paper chromatography was carried out. The chromatogram shown was obtained.



The dye(s) present in the fake note are/were

A 3, 4 and 5
B 2 and 3
C 6 only
D 3 and 4

2 Which pair correctly describes the structure of an atom?

	particles orbiting the nucleus	particles in the nucleus
A	protons	electrons and neutrons
B	electrons and neutrons	protons
C	electrons	protons and neutrons
D	protons and neutrons	electrons

3 What is the electronic configuration of the silicon isotope, $^{30}_{14}Si$?

A 2.8.4
B 4.8.2
C 2.8.8.8.4
D 8.4.2

4 Which row correctly gives the physical properties of an ionic compound?

	melting point/ °C	electrical conductivity when solid	electrical conductivity when molten
A	high	none	none
B	low	conducts	conducts
C	high	none	conducts
D	low	none	none

5 The table shows the atomic numbers of two elements, P and Q.

element	atomic number
P	19
Q	17

Elements P and Q can combine to form

A a covalent compound PQ.
B a covalent compound PQ_2.
C an ionic compound PQ.
D an ionic compound PQ_2.

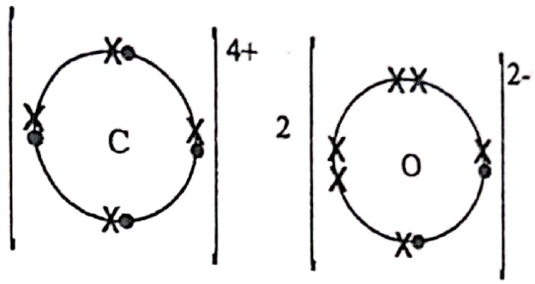
6 What is the correct formula of the compound formed between M^+ and Z^{2-}?

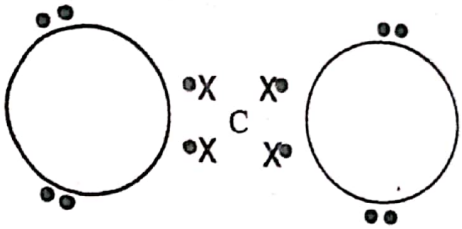
A MZ
B MZ_2
C M_2Z
D M_2Z_2

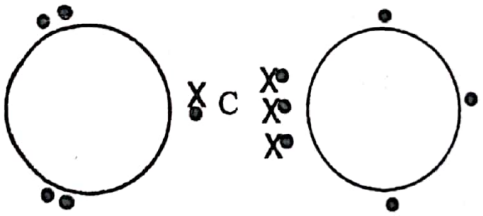
[Turn over

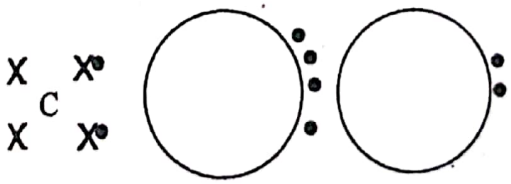
1 Which structure correctly shows the bonding in carbon dioxide?

Key:
X carbon electrons
● Oxygen electrons

A 

B 

C 

D 

8 A 0.1 moldm^{-3} solution of sodium carbonate can be prepared by dissolving

A 106 g of $Na_2CO_{3(s)}$ in 100 cm^3 of water
B 10.6 g of $Na_2CO_{3(s)}$ in 100 cm^3 of water
C 10.6 g of $Na_2CO_{3(s)}$ in 1000 cm^3 of water
D 106 g of $Na_2CO_{3(s)}$ in 1000 cm^3 of water

9 Phosphoric acid and potassium hydroxide react according to the equation:

$$H_3PO_{4(aq)} + 3KOH_{(aq)} \rightarrow K_3PO_{4(aq)} + 3H_2O_{(1)}$$

Which ions will not appear in the ionic equation?

A $H^+_{(aq)}$ and $OH^-_{(aq)}$

B $K^+_{(aq)}$ and $PO^{3-}_{4(aq)}$

C $H^-_{(aq)}$ and $PO^{3-}_{4(aq)}$

D $K^+_{(aq)}$ and $OH^-_{(aq)}$

10 Which equation does **not** result in a change of oxidation state of the species involved?

A $Fe^{2+}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + e^-$

B $Cu^{2+}_{(aq)} + CO^{2-}_{3(aq)} \rightarrow CuCO_{3(s)}$

C $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

D $Ag^+_{(aq)} + e^- \rightarrow Ag_{(s)}$

11 The production of carbohydrates during photosynthesis is an example

A an endothermic reaction.
B a combustion reaction.
C an exothermic reaction.
D a displacement reaction.

12 Sulphur dioxide reacts with oxygen according to the equation:

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -188 \text{ kJ/mol}$$

Which factor increases the amount of sulphur trioxide produced?

A increase in temperature
B decrease in temperature
C increase in amount of catalyst
D decrease in pressure

13 A new element has been discovered and is believed to be between zinc and lead in the electrochemical series.

How will the element react with solutions of zinc sulphate and lead nitrate.

	zinc sulphate	lead nitrate
A	zinc displaced	lead remains in solution
B	zinc remains in solution	lead displaced
C	zinc displaced	lead displaced
D	zinc remains in solution	lead remains in solution

14 When heated, a metal carbonate decomposes to form

A metal oxide and carbon
B carbon dioxide and metal
C carbon monoxide and metal oxide
D carbon dioxide and metal oxide

15 Nitrogen and oxygen are separated from liquid air by the process of

A liquefaction
B solidification
C fractional distillation
D condensation

16 Which reagent could be used to distinguish between aluminium nitrate and zinc nitrate?

A sodium hydroxide solution
B ammonia solution
C barium chloride solution
D silver nitrate solution

17 A compound of nitrogen and hydrogen contains 87.5 % nitrogen.

What is its empirical formula?

A N_2
B NH_2
C N_2H_2
D N_2H_4

18 Respiration, combustion and rusting are chemical processes which all use

A water.
B heat energy.
C carbon dioxide.
D oxygen.

19 Which one is **not** a property of transition metal ions?

A They act as catalysts.
B Their solutions are colourless.
C Their solutions are coloured.
D They have many oxidation states.

20 Which pair correctly matches a metal and its extraction method?

	metal	method
A	iron	electrolysis
B	platinum	reduction
C	gold	electrolysis
D	nickel	reduction

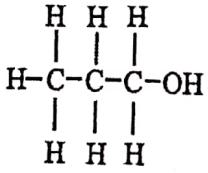
21 In the blast furnace, molten iron is tapped off at the bottom of the furnace while slag settles above the molten iron because

A slag is more dense than molten iron.
B slag is less dense than molten iron.
C molten iron and slag have the same density.
D molten iron occupies more space than slag.

22 Copper metal is used in electrical wiring and manufacture of pots and pans because of its

A high conductivity
B high reactivity
C cheap cost of production
D abundance in nature

23 Which structures represents the same compound?



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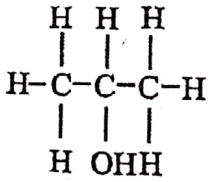

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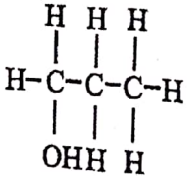

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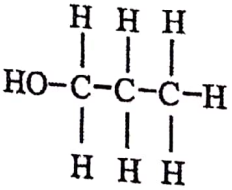


4

A 2 and 4
B 1 and 2
C 1 and 3
D 2 and 3

24 Which homologous series of organic compounds has the general formula C_nH_{2n}?

A alcohols
B carboxylic acids
C alkanes
D alkenes

25 When two molecules react to form one molecule, this is

A an addition reaction.
B a substitution reaction.
C a condensation reaction.
D an esterification reaction.

26 Ethene may be manufactured according to the reaction:

$$C_2H_6 \xrightarrow{\text{heat}} C_2H_4+H_2$$

What type of reaction is this?

A polymerisation
B cracking
C addition
D hydrogenation

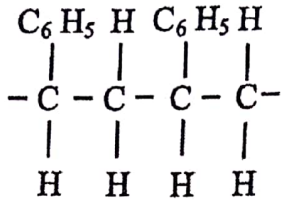
27 Which one is an example of a saturated hydrocarbon?

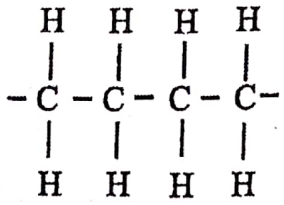
A butane
B ethanol
C butene
D butanol

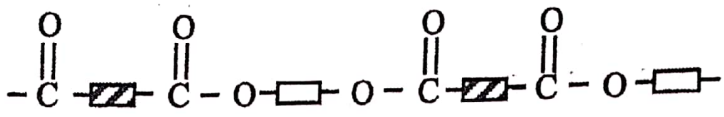
28 Which compounds react to form ethylethanoate?

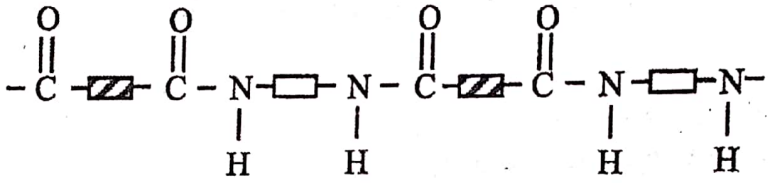
A ethane and ethanol
B ethanoic acid and ethanol
C ethene and ethanoic acid
D ethane and ethanoic acid

29 Which structural formula represents nylon?

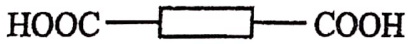
A 

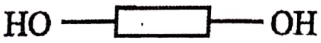
B 

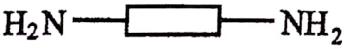
C 

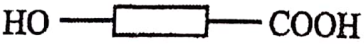
D 

30 Which monomer unit polymerises to form starch?

A 

B 

C 

D 

31 Which process describes the secondary stage of sewage treatment?

A sedimentation
B sludge activation
C precipitation
D discharge

32 Which ion is common to both sewage and fertilizers?

A nitrate
B carbonate
C chloride
D sulphate

33 Which process increases the amount of sulphur dioxide in the air?

A burning methane
B burning coal
C burning wood
D burning ethene

34 Which pair correctly matches a pollutant gas and its effect on the environment?

	pollutant	effect
A	SO_2	depletes the ozone layer
B	NO_2	global warming
C	CFC	form photochemical smog
D	CO_2	global warming

35 Oxides of nitrogen are produced in car engines because the

A bonds in nitrogen gas are easy to break.
B reactions can take place without interference.
C car engines have high temperatures for this reaction.
D reaction only need moderate warmth to proceed.

36 All of the following are used in waste management except

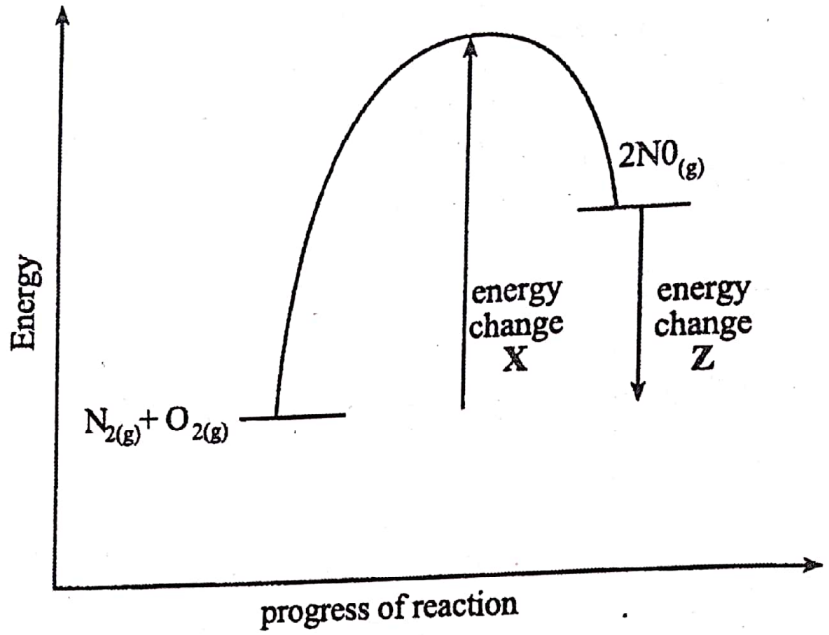
A composting.
B source reduction.
C incineration.
D logging.

37 Charcoal is used in the purification of water because it

A coagulates the water.
B removes inorganic ions.
C makes water colourless.
D disinfects the water.

38 The diagram shows the energy profile for the reaction

$$N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}.$$



What is the energy change X?

A enthalpy of combustion
B bond energy
C enthalpy of reaction
D activation energy

39 Which one is an advantage of using herbal medicines?

A herbal medicines cure better than pharmaceutical medicines.
B herbal medicines are easily metabolized because they are organic.
C herbal medicines are cheaper than pharmaceutical medicines.
D herbal medicines have clear directions for use.

40 Which chemical process takes place during the production of biodiesel?

A esterification
B addition
C hydrogenation
D combustion

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group O
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a / X / b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm³ at room temperature and pressure (r.t.p.)

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Ordinary Level

EXPECTED ANSWERS

CHEMISTRY	NOV 2018	4024/1

1	A
2	C
3	A
4	C
5	C
6	C
7	B
8	C
9	B
10	C
11	A
12	A
13	B
14	D
15	C
16	B
17	B
18	D
19	B
20	D

21	B
22	A
23	A
24	D
25	A
26	B
27	A
28	B
29	D
30	B
31	B
32	A
33	B
34	D
35	C
36	D
37	D
38	D
39	C
40	A

Candidate | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

4024/2

PAPER 2 Theory

NOVEMBER 2018 SESSION

2 hours

Candidates answer on the question paper.
Additional materials: Electronic calculator

Allow candidates 5 minutes to count pages before the examination

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page and centre number and candidate number on top of the right corner of every page of this paper. Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A

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

Section B

Answer any **four** 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 paper.

A copy of the periodic table is provided on **page 22**.

This question paper consists of 22 printed pages and 2 blank pages.

Section A

*Answer **all** the questions in the spaces provided.*

1 (a) **Fig.1** shows the atomic structures of two elements, **D** and **E**.

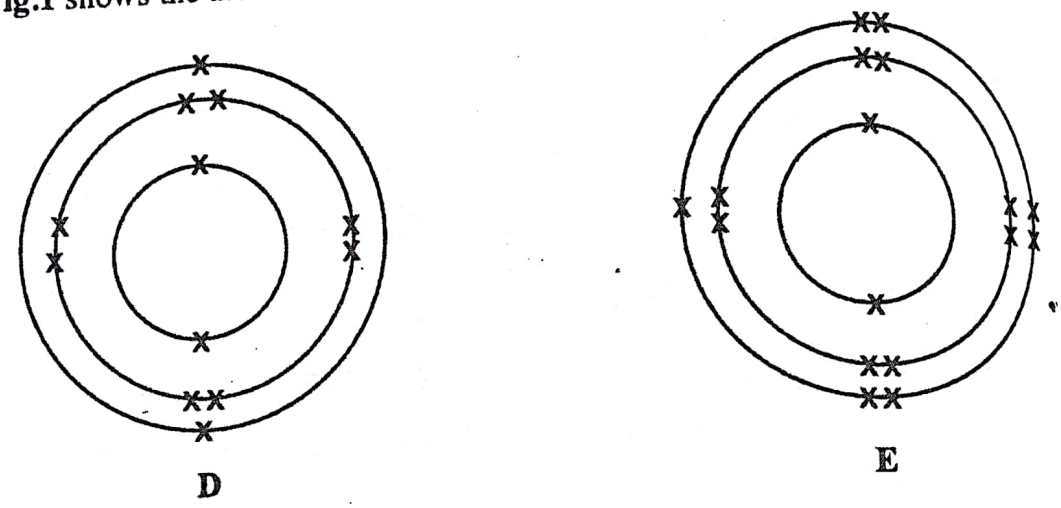


Fig.1.1

(i) State the number of protons in **E**.

_____ [1]

(ii) State the type of bonding that exists

1. between particles of **D**,

_____ [1]

2. in the compound formed when **D** and **E** combine.

_____ [1]

(iii) Write the formula of the compound formed when **D** reacts with **E**.

_____ [1]

1 (a) (iv) Draw a dot and cross diagram to show the bonding in the compound formed between **D** and **E**.

(b) State any **two** physical properties of the compound formed between **D** and **E**.

1. _____

_____ [1]

2. _____

_____ [1]

2 In an experiment, 0.3 moles of copper were completely dissolved in concentrated sulphuric acid to produce white anhydrous copper (II) sulphate, sulphur dioxide and water.

(a) (i) Write a balanced chemical equation for the reaction.

[2]

2 (a) (ii) Calculate the

1. volume of the sulphur dioxide produced during the reaction.

[2]

2. maximum mass of copper (II) sulphate produced.

[2]

(iii) The actual mass of copper (II) sulphate obtained in the experiment was 23.8 g.

Calculate the percentage yield of the product.

[2]

[Total:8]

Toothpaste contains a fluoride, magnesium hydroxide, an abrasive and a flavouring agent.

(a) (i) Give the formula of magnesium hydroxide.

[1]

(ii) Give the formula of an anion with the same electronic configuration as Mg^{2+}.

[1]

(iii) State with a reason, the group of the periodic table to which magnesium belongs.

group _____ [1]

reason _____

_____ [1]

(b) (i) Explain the function of magnesium hydroxide in the toothpaste.

_____

_____

_____ [1]

(ii) Write an ionic equation that represents the action of magnesium hydroxide.

[1]

3 (c) Describe a chemical test for the magnesium ion.

[2]

[Total:8]

4 The reaction scheme in **Fig.4.1** shows how some organic compounds are produced.

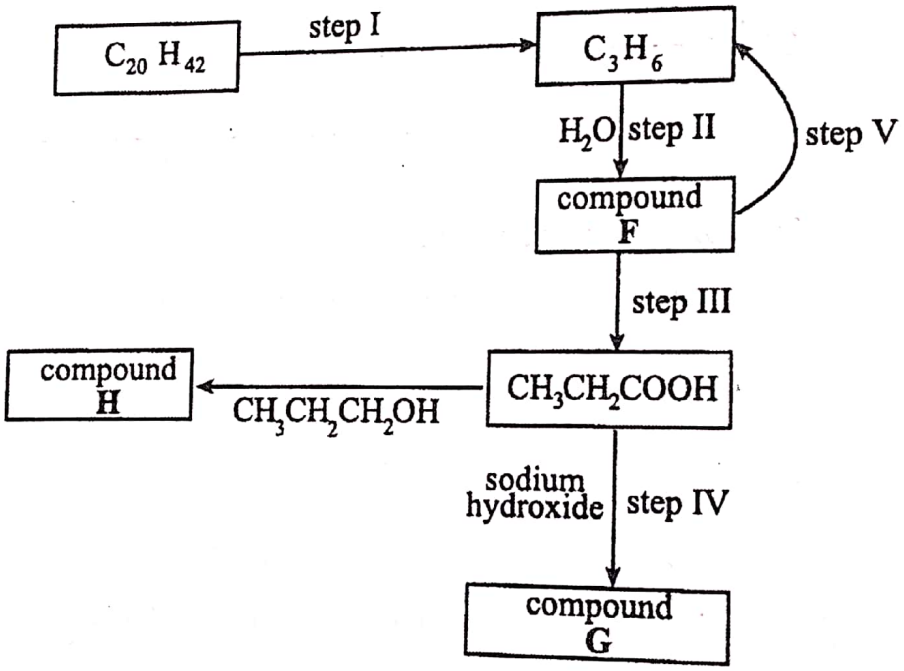


Fig.4.1

(a) (i) State the type of reaction occurring in

1. Step I, _____

2. Step II, _____

3. Step III, _____

4. Step IV. _____

(ii) Give the reagents and conditions for Step V.

reagent(s) _____

_____ [1]

condition _____

_____ [1]

(b) (i) Write the structural formula of

1. **G,**

[1]

2. **H.**

[1]

(ii) Name the catalyst required for the formation of **H.**

_____

_____ [1]

[Total:8]

5 An investigation to identify dyes used to colour food was carried out. The chromatogram shown in **Fig.5.1** was obtained.

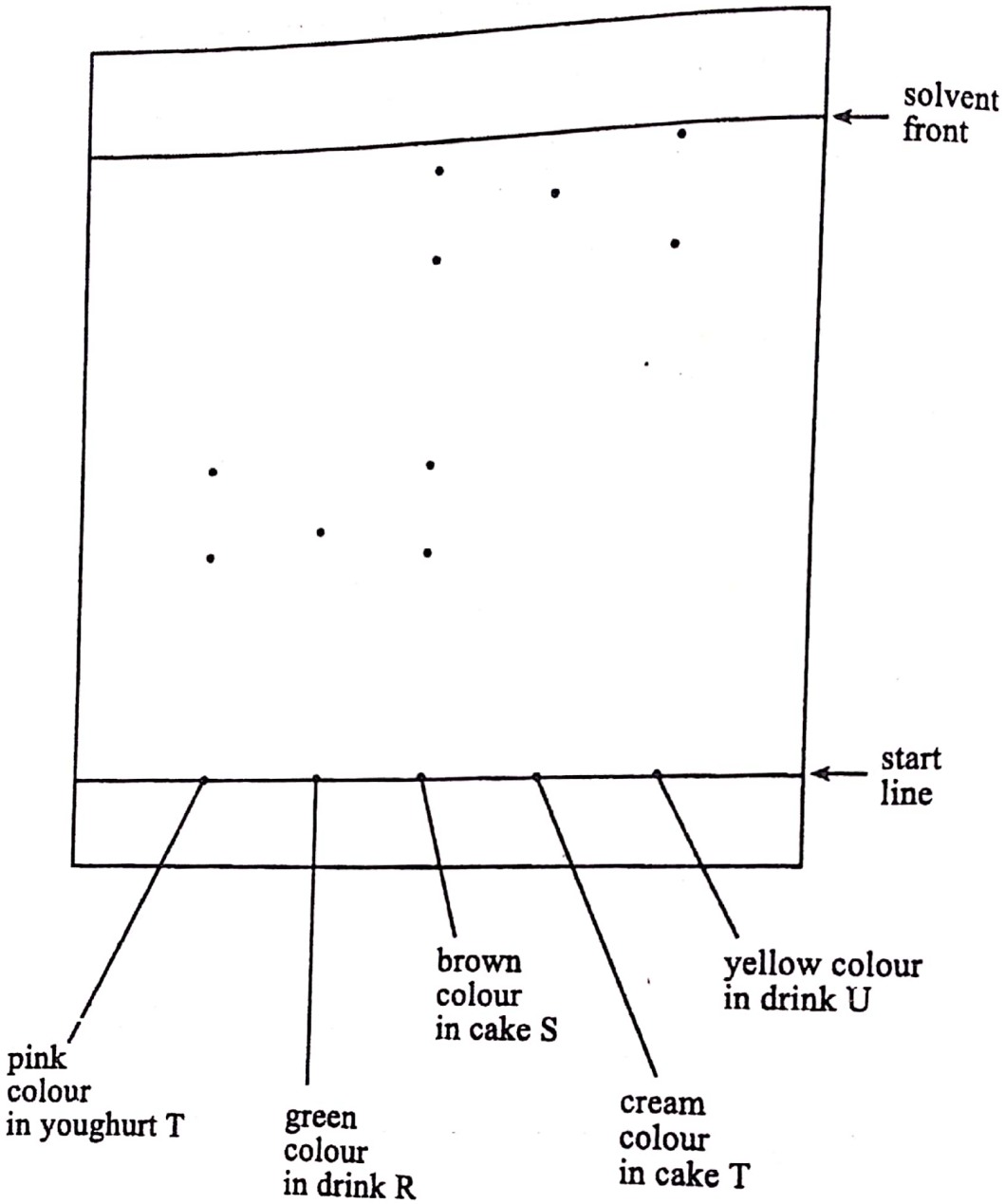


Fig. 5.1

(a) (i) State the samples that have single dyes.

[2]

5 (a) (ii) State the colours that could be mixed to make the brown colour in cake S.

_____ [2]

(b) Calculate R_f values of the two dyes present in the pink colour in yoghurt.

1. lower spot

[2]

2. upper spot

[1]

(c) Give any **one** advantage of using thin layer chromatography over paper chromatography.

_____

_____ [1]

[Total:8]

Section B

Answer any **four** questions from this section in the spaces provided.

6 (a) (i) State the oxidation number of Cr in

1. Cr_2O_3 _____ [1]

2. Na_2CrO_4 _____ [1]

(ii) Calculate the percentage by mass of Cr in $K_2Cr_2;O_7$.

[3]

(a) (iii) Explain why $K_2\ Cr_2O_7$ is used to test for the presence of sulphur dioxide gas.

_____

_____

_____ [3]

6 (c) (ii) Conversion of Fe_3O_4 to Fe metal in the blast furnace.

type of change _____

reason _____

_____ [2]

[Total:15]

7 **Fig.7.1** shows a simple cell.

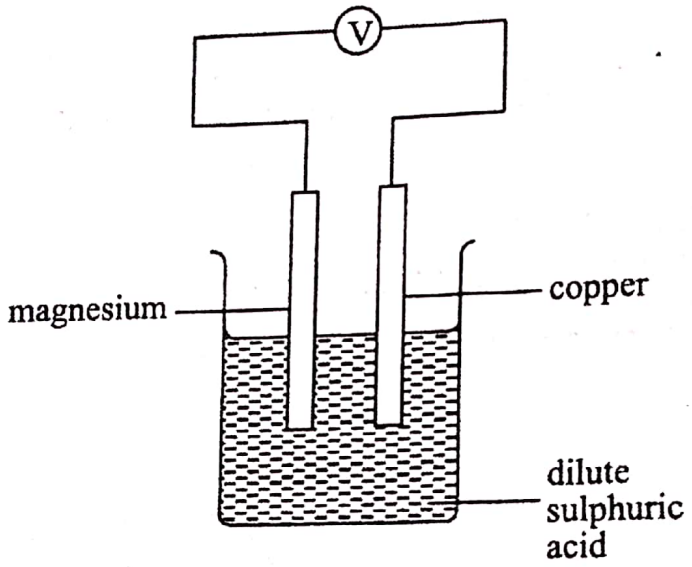


Fig.7.1

(a) (i) Label, on **Fig.7.1**, the positive and negative electrodes. [2]

(ii) Explain how this simple cell produces an electric current.

_____

_____

_____ [3]

(ii) State and explain the effect of replacing magnesium with

1. zinc, _____

_____

_____ [2]

2. copper. _____

_____

_____ [1]

(b) A piece of an iron wire was reacted with dilute hydrochloric as shown in **Fig.7.2.**

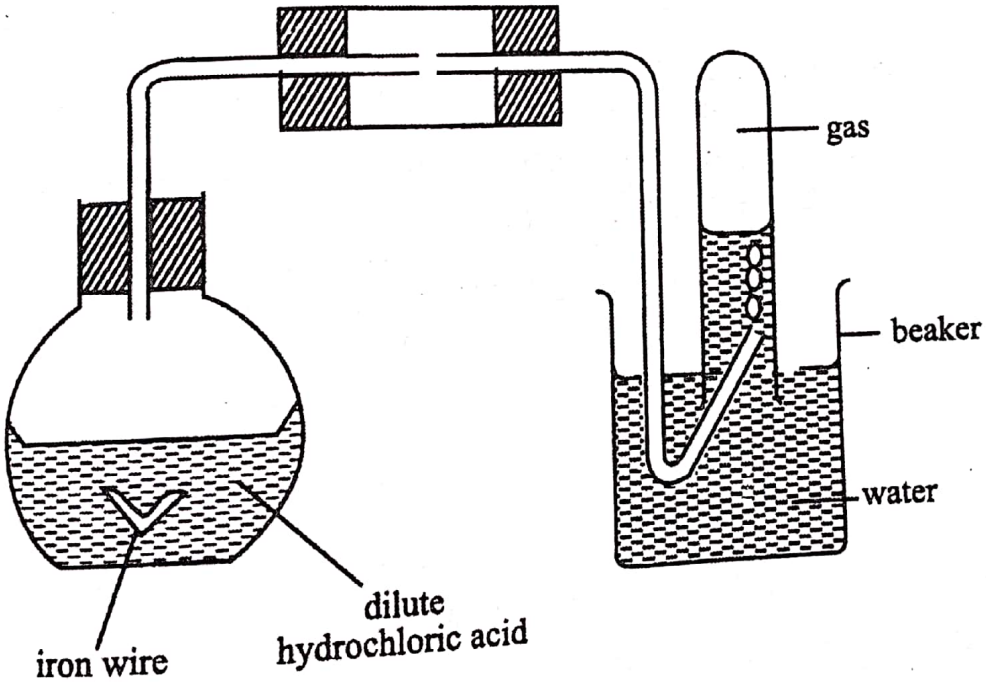


Fig.7.2

(i) Name the gas produced. [1]

_____

[Turn over

7 (b) (ii) Describe a chemical test for the gas.

[2]

(iii) Name, with reasons, the compound that remains in the flask.

[2]

(iv) Suggest how the rate of the reaction, at room temperature and pressure, can be increased.

[2]

[Total:15]

8 (a) (i) Define the term *isomer*.

[1]

Centre Number	Candidate Number

15

(a) (ii) Draw the structural formulae of the two branched chain isomers of the hydrocarbon, C_6H_{14} and name them.

[4]

(b) **Fig.8.1** shows how glucose can be converted into other organic compounds.

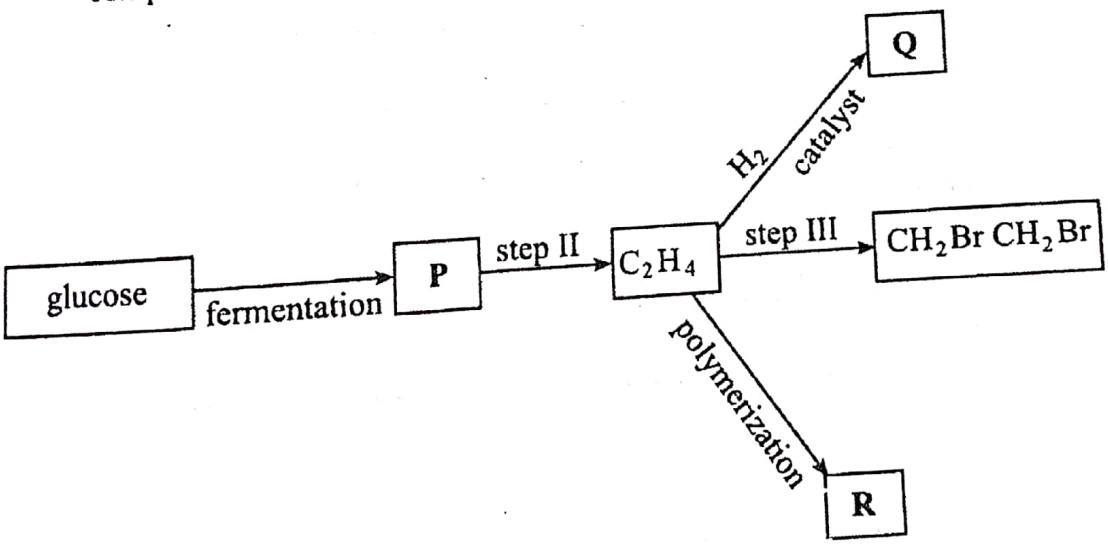


Fig.8.1

(i) Describe the conditions necessary for the fermentation.

[2]

[Turn over

8 (b) (ii) Name the

1. product **P**, _____

2. Compound CH_2BrCH_2Br. _____ [2]

(iii) State the type of reaction in

1. Step II, _____

2. Step III _____ [1]

(vi) Describe the chemical test for C_2H_4

_____

_____

_____

_____ [3]

(v) Give the structural formula of the organic products **Q** and **R**.

[2]

[Total: 15]

Centre Number	Candidate Number

9 **Fig.9.1** shows part of the Periodic table. The positions of some elements are shown by the letters.

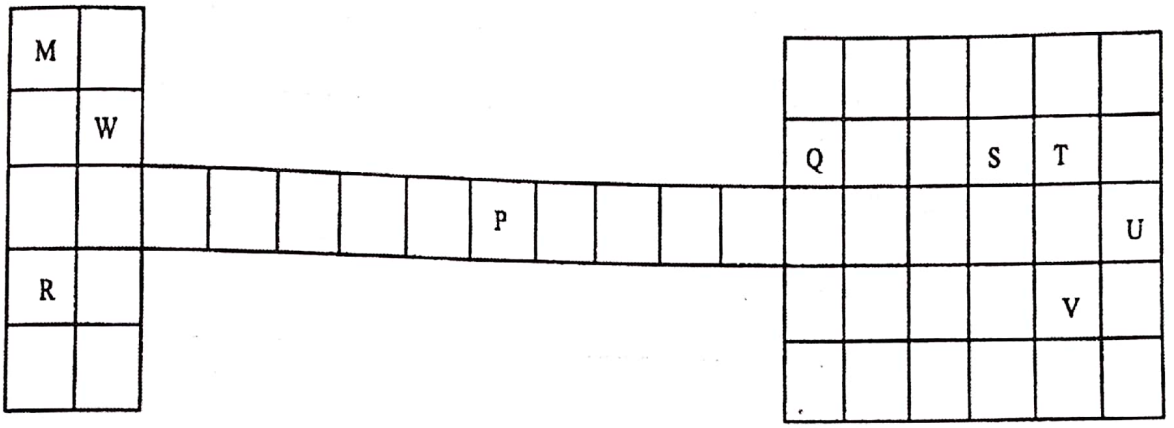


Fig.9.1

(a) (i) State the letter that represents an element that forms a coloured compound with chlorine.

_____

_____ [2]

(ii) Draw a diagram to show the arrangement of electrons in the element represented by the letter **T**.

[2]

(iii) State the **two** letters that represent elements that react together most vigorously.

_____

[1]

9 (a) (iv) Describe and explain how the atomic radius changes down the group from the element represented by **T** to **V**.

[2]

(b) (i) Explain why the element represented by

1. **W** is a metal,

2. **T** is a non metal.

[2]

(ii) State, with a reason, the acid-base nature of the oxide of the element represented by **Q**.

[2]

9 (c) Describe and explain the trend in the volatility of Group

10 Fig.10.1 shows some of the reactions of a soluble transition metal compound **Y**.

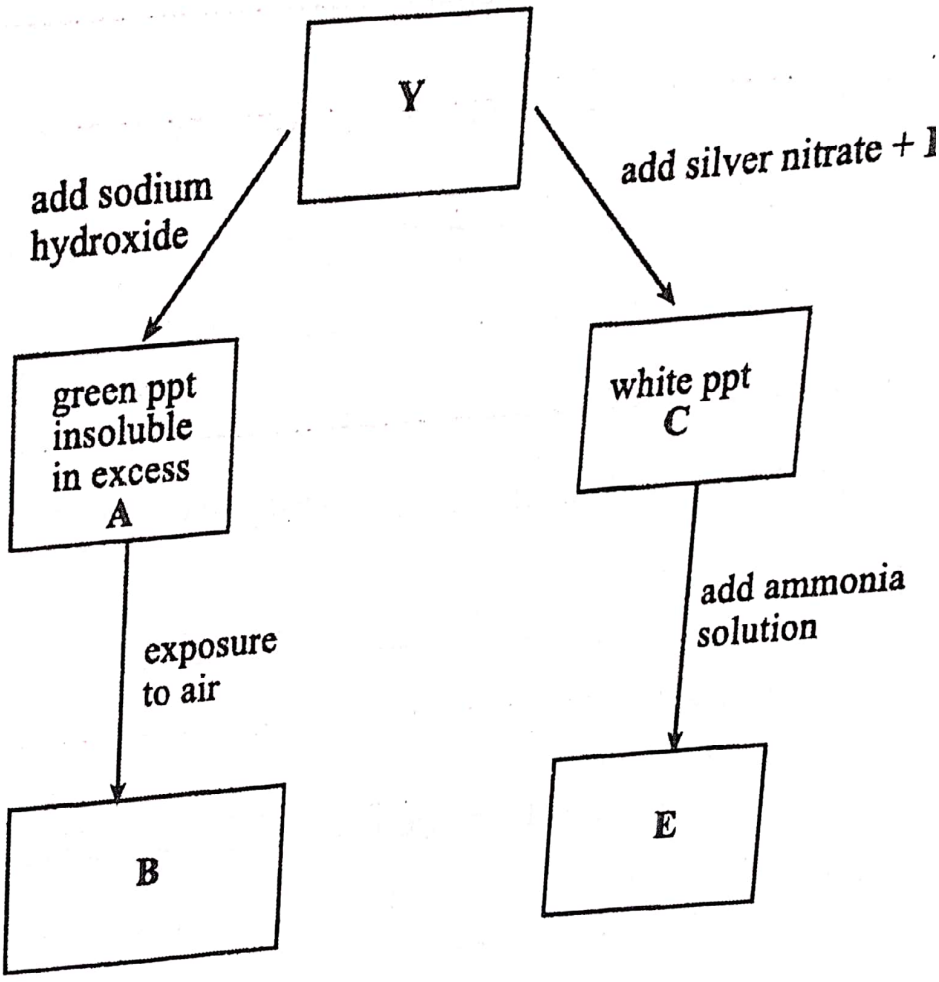


Fig.10.1

10 (a) (i) Deduce the molecular formula of **Y**.

[Tu

10 (a) (ii) Describe the colour of solution **Y**.

_____

_____ [1]

(iii) Identify substances **B, C** and **D**.

B _____

C _____

D _____ [3]

(iv) Describe the observation made during the formation of **E**.

_____

_____

_____ [2]

(b) (i) Name the chemical method used to obtain iron in the blast furnace.

_____ [1]

(ii) Explain why

1. SiO_2 is used to construct the bricks of the blast furnace walls,

_____

_____ [1]

2. MgO is used as a refractory lining of the blast furnace,

_____

_____ [1]

Centre Number	Candidate Number

10 (b) (ii) 3. the blast furnace is never extinguished.

_____

_____ [1]

(c) (i) Give the chemical formula of slag.

_____

_____ [1]

(ii) State the role of slag in the blast furnace.

_____

_____ [1]

(iii) Give **two** advantages of the use of alloys over pure metals.

_____

_____ [2]

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group O
											1 H Hydrogen 1						4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromide 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pd Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2018

4024/2

CHEMISTRY

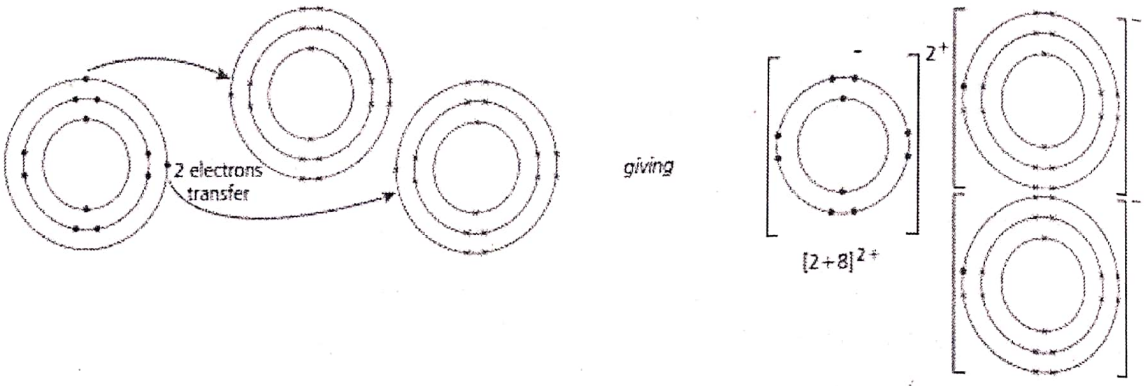
1. **(a) (i)** 17

(ii) -Metallic bonding

-Ionic Bonding

(iii) - DE_2

(iv)



(b) -high melting point
-high boiling point
-soluble in water
-brittle
-solid at room temperature and pressure
-conducts electricity when dissolved in water or when in molten state.

---

2. **(a)** **(i)** $Cu_{(s)} + 2H_2SO_{4(l)} \rightarrow SO_{2(g)} + CuSO_{4(s)} + 2H_2O(aq)$

(ii) **1** volume of gas = n × molar gas volume

$= 0.3 \times 24dm^3$

$=\mathbf{7.2dm^3}$

2. Mass = n × molar mass

$= 0.3 \times 160$

$=\mathbf{48g}$

(iii) Percentage yield $= \frac{\text{experimental mass of product}}{\text{maximum possible mass}} \times 100\%$

$= \frac{23.8}{48} \times 100\%$

$= 49.58\%$

3. (a) (i) $Mg(OH)_2$

(ii) O^{2-}/N^{3-}

(iii) 2;

(b) (i) -Neutralise acids that are formed by the action of bacteria on plaque

(ii) $Mg(OH)_2 + 2H^+ \rightarrow Mg^{2+} + 2H_2O$

(c) -Add sodium Hydroxide to the test solution.
-A white precipitate is formed which is insoluble in excess

4. (a) (i) 1. Cracking
2. Addition/Hydration
3. Oxidation
4. Neutralisation/Acid Base Reaction

(ii) -concentrated $H_2SO_{4(l)}$ at 300°C / hot Al_2O_3

(b) (i) $-CH_3CH_2COO^-Na^+$

$-CH_3CH_2COOCH_2CH_2CH_3$

(ii) Concentrated $H_2SO_{4(l)}$

5. (a) (i) - Cream colour in cake T
-Green colour in drink R

(ii) -Yellow colour in drink U
-Pink colour in yoghurt

(b) 1. $R_f \text{ for lower spot} = \frac{\text{distance moved by solute}}{\text{distance moved by solvent}}$

$= \frac{2.8}{7.9}$

$= 0.354$

2. $R_f \; for \; upper \; spot = \frac{distance \; moved \; by \; solute}{distance \; moved \; by \; solvent}$

$= \frac{3.9}{7.9}$

$= \mathbf{0.494}$

(c)
-better separation
-bands are sharper
-bands are further spaced out
-high speed/sensitivity
-small sample is required

---

6. **(a) (i)** **1.** +3
2. +6

(ii) $M_r(K_2Cr_2O_7) = 294$

$= \frac{104}{294} \times 100\%$

$= 35.4\%$

(iii) $K_2Cr_2O_7$ Changes colour from orange to green. It is an oxidising agent

(b)

Conditions	Effect on amount of A_2	Effect on amount of AB
increase in pressure	No change	No change
increase in temperature	Decreases	Increases

(c) (i) Oxidation

-loss of electrons by OH^-
-increase in oxidation state of oxygen

(ii) Reduction

-Removal of Oxygen
-Decrease in oxidation state of iron

7. (a) (i) -positive: copper
-Negative: Magnesium

(ii) -Magnesium is more reactive; it gives up electrons
-Electrons move from Magnesium to Copper
-H^+ ions gains electrons forming hydrogen gas
-Electrolyte completes the circuit

(iii) 1. -Voltage decreases
-decrease in $H_{2(g)}$ bubbles
-Current decreases

-Reason: Zn is closer to Cu than Mg

2. -No voltage is produced
-No bubbles produced
-No current produced

-Reason: No reaction occurs

(b) (i) -Hydrogen

(ii) -Use a burning splint

-Hydrogen burns with a pop sound

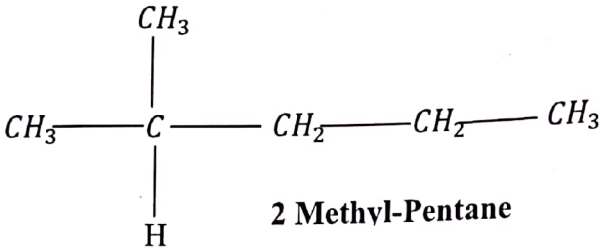
(iii) -$FeCl_2$ - product of the reaction
-Unreacted HCl

(iv) -use powdered iron to increase surface area
-Increase concentration of HCl
-use a catalyst

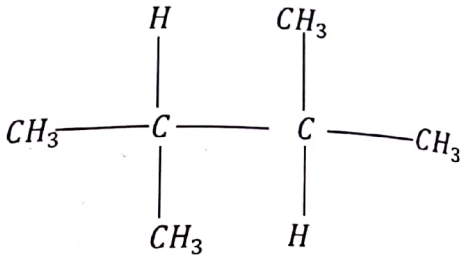
---

8. (a) (i) -substances with the same molecular formula but differ in arrangement of atoms.

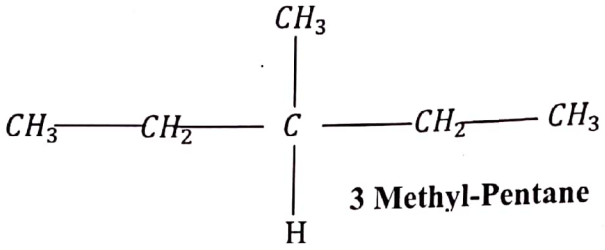
(ii)



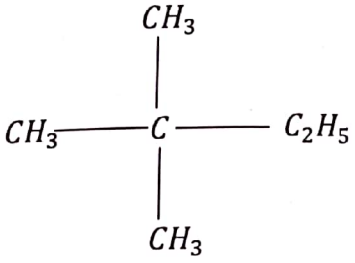
2 Methyl-Pentane



2,3 Dimethyl Butane



3 Methyl-Pentane



2,2 Dimethyl Butane

(b) **(i)** -absence of oxygen/Anaerobic conditions
-Enzyme from yeast/Zymase
-Temperature between $37°C - 40°C$

(ii) **1.** Ethanol

2. 1.2 Dibromo-ethane

(iii) **1.** Dehydration

2. Addition

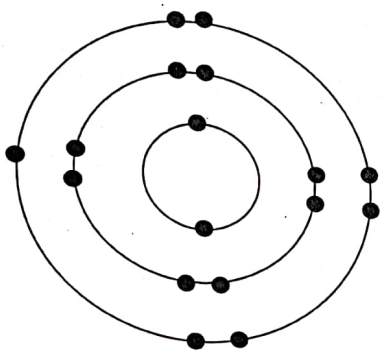
(iv) -React C_2H_4 with aqueous bromine
-the bromine is decolourised

(v) **Q** $CH_3CH_3 - Q$

R $-CH_2-CH_2-$

9. **(a)** **(i)** P

(ii)



(iii) R and T

(iv) -Atomic radius increases

-Increase in number of shells

(b) **(i)** **-W** has a tendency of losing electrons

-T has a tendency of gaining electrons

(ii) -Oxide of Q is amphoteric

-It exhibits both acid and basic properties

(c) -volatility decreases down the group
-this is because of the increase in strength of forces as the number of electrons increases
-physical state at room temperature changes from gas to solid.

---

10. **(a)** **(i)** $-FeCl_2$

(ii) -green solution/yellowish green solution.

(iii) B: $Fe(OH)_2$

C: $AgCl$

D: HNO_3

(iv) -white precipitate dissolves in ammonia to give a colourless solution.

(b) **(i)** reduction

(ii) **1.** Giant molecular structure with strong $(Si - O)$ bonds.

2. MgO has a higher melting point

3. To prevent solidification of iron

(c) **(i)** -$CaSiO_3$

(ii) -To prevent oxidation of Iron

(iii) -Alloys have greater tensile strength
-Alloys resist corrosion
-decoration purposes

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 4024/1

PAPER 1 Multiple Choice

NOVEMBER 2019 SESSION 1 hour

Additional materials:
Multiple Choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)
Electronic calculator

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, centre number and candidate number on the answer sheet in the spaces provided unless this has already been done for you.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate answer sheet.

Read very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score **one** mark. A mark will **not** be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 14.

This question paper consists of 14 printed pages and 2 blank pages.

1. Which gas has the smallest rate of diffusion?

A methane

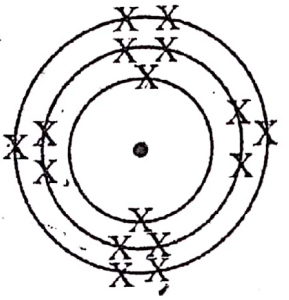
B ammonia

C carbon dioxide

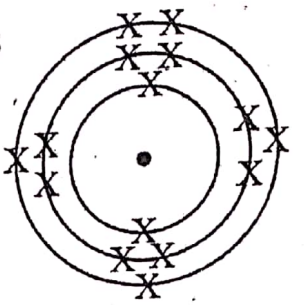
D hydrogen chloride

2. Which diagram correctly represents a sulphide ion, S^{2-}?

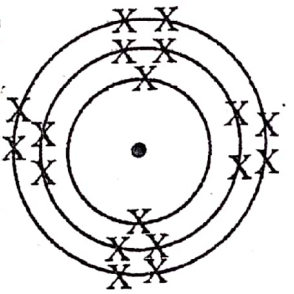
A



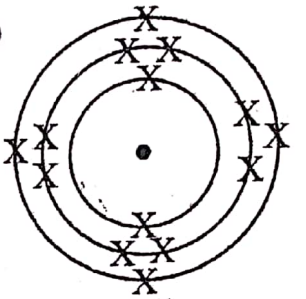
B



C



D



3. Which apparatus is used to measure an exact volume of 25.00 cm^3?

A a 50.00 cm^3 burette

B a 25.00 cm^3 pipette

C a 25.00 cm^3 conical flask

D a 25.00 cm^3 measuring cylinder

What is the volume occupied by three moles of carbon dioxide at r.t.p?

4. A $24\ dm^3$

B $28\ dm^3$

C $72\ dm^3$

D $84\ dm^3$

5. The chemical formula $2NH_3$ represents

A six molecules of hydrogen.

B two molecules of ammonia.

C two molecules of nitrogen.

D two atoms of ammonia.

6. An exothermic reaction is one which has

A more gaseous reactants than products.

B more gaseous products than reactants.

C a greater bond formation energy than bond breaking energy.

D a greater bond breaking energy than bond formation energy.

7. The main function of limestone in the blast furnace is to

A oxidise iron ore.

B reduce iron ore.

C remove impurities.

D remove excess carbon.

8. Which gas decreases in concentration during eutrophication in a pond?

A hydrogen

B methane

C nitrogen

D oxygen

9. Which method of waste disposal is a source of carcinogens ?

A bio-digestion

B incineration

C recycling

D landfilling

10. What happens to the oxidation number of nickel when nickel ore , *NiS*, is changed to pure nickel?

A increases to +1

B decreases to zero

C decreases to +2

D increases to zero

11. Which chemical is a pollutant from gold processing?

A Hg

B $Al_2(SO_4)_3$

C HCl

D Pb

The stages show reactions that occur in the contact process.

12. At which stage is the formation of an acid spray prevented?

A $S + O_2 \longrightarrow SO_2$

B $2SO_2 + O_2 \rightleftharpoons 2SO_3$

C $SO_3 + H_2SO_4 \longrightarrow 2H_2S_2O_7$

D $H_2S_2O_7 + H_2O \longrightarrow + 2H_2SO_4$

13. Which one is a chemical property of a metal?

A forms positive ions

B forms negative ions

C forms acidic oxides

D forms coloured solutions

14. Which element is least reactive?

A Fe

B Mg

C Na

D Zn

15. What is obser[illegible]

16. Which metal is added to steel to give it anti-corrosion properties?

A chromium

B copper

C zinc

D gold

17. The pH values of four solutions, W, X, Y and Z, are shown in the table.

solution	pH
W	3
X	5
Y	7
Z	11

Which solution can be used to neutralize an acidic soil?

A W

B X

C Y

D Z

18. The correct order of preparing some salts from a metal and an acid is

A crystallisation ⟶ evaporation ⟶ displacement ⟶ filtration.

B displacement ⟶ filtration ⟶ evaporation ⟶ crystallisation .

C evaporation ⟶ crystallisation ⟶ filtration ⟶ displacement .

D filtration ⟶ evaporation ⟶ displacement ⟶ crystallisation.

19. Which substance is reduced in the reaction shown?

$$CaO + C \longrightarrow Ca. + CO_2$$

A CaO

B C

C Ca

D CO_2

20. Which is **not** a reason for electroplating metals?

A decorating

B protecting

C improving purity

D improving electrical conductivity

21. Lathering of soap is a test for the

A purity of water.

B acidity of water.

C hardness of water.

D alkalinity of water.

22. Ammonia gas reacts with dilute hydrochloric acid as shown in the equation:

$$NH_{3(g)} + HCl_{(aq)} \longrightarrow NH_4Cl_{(aq)}$$

What mass of ammonium chloride is formed if 8.5 g of ammonia gas is used?

A 2.70 g

B 4.25 g

C 8.50 g

D 26.75 g

23. An organic compound has 92.3 % carbon and 7.7 % hydrogen by mass.

The empirical formula of the compound is

A C_3H_5.

B C_2H_3.

C CH_2.

D CH.

24. A hydrocarbon has an empirical formula of CH_2 and a relative molecular mass of 28.

What is the percentage composition of carbon in the hydrocarbon?

A 14 %

B 21 %

C 50 %

D 86 %

25. A breathalizer is an instrument used to measure the amount of alcohol in a breath. The device contains potassium dichromate which reacts with alcohol in the breath.

If the breath contains alcohol the colour changes from

A green to orange.

E orange to green.

C pink to purple.

D purple to pink.

26. Which molecular formula could be that of candle wax?

A C_4H_{10}

B C_6H_{12}

C C_8H_{18}

D $C_{20}H_{42}$

27. Ethanoic acid reacts with methanol according to the equation

$CH_3COOH + CH_3OH \longrightarrow CH_3COOCH_3 + H_2O$

What is the name of the ester formed?

A methylpropanoate

B methylethanoate

C ethylethanoate

D ethylmethanoate

28. A hydrocarbon, X, can crack as shown

$$X \xrightarrow{heat} C_2H_4 + C_8H_{18}$$

What could be X?

A C_6H_{14}

B C_8H_{18}

C $C_{10}H_{22}$

D $C_{16}H_{36}$

29. One of the products of heating methane in **excess** oxygen is

A carbon.

B soot.

C carbon monoxide.

D carbon dioxide.

30. Amino acids react to form a large protein molecule and water as shown.

amino acids $\longrightarrow$ protein molecule + water.

The process is called

A hydrolysis.

B elimination.

C addition polymerisation.

D condensation polymerisation.

31. An organic compound **Q** reacted with one mole of hydrogen in the presence of a catalyst.

What could be **Q**?

A an alcohol

B a carboxylic acid

C an alkene

D an alkane

Which reaction can be used to distinguish ethane from ethene?

32. **A** reacting both with chlorine in UV light

B reacting both with bromine water in UV light

C reacting both with bromine water in the dark

D reacting both with hydrogen gas

The reaction between an alkene and bromine in the dark is

33. **A** an addition reaction.

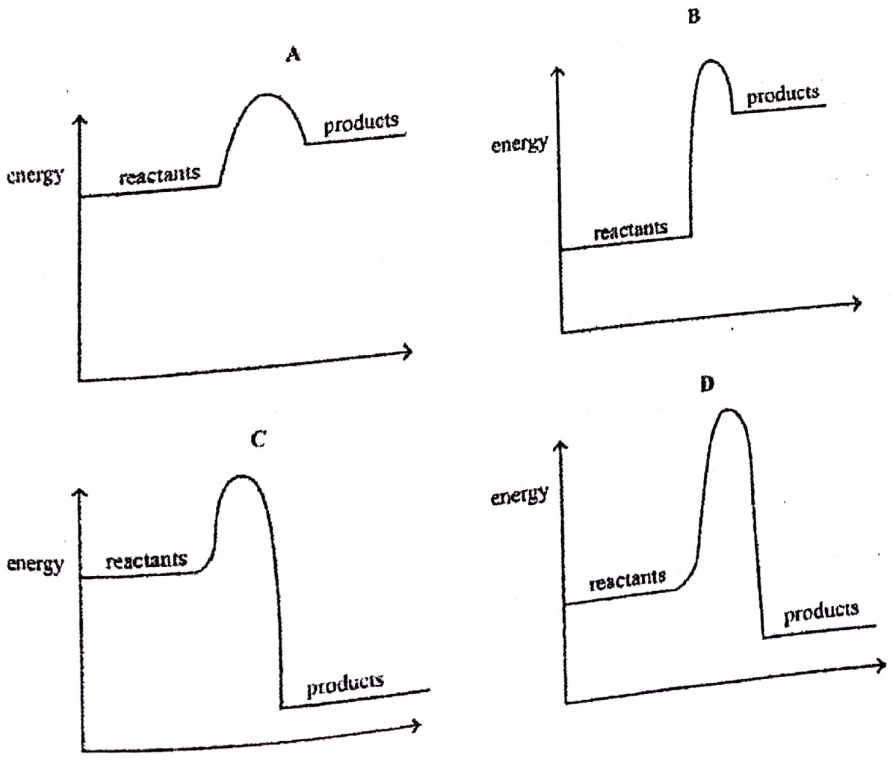
B an oxidation reaction.

C a reduction reaction.

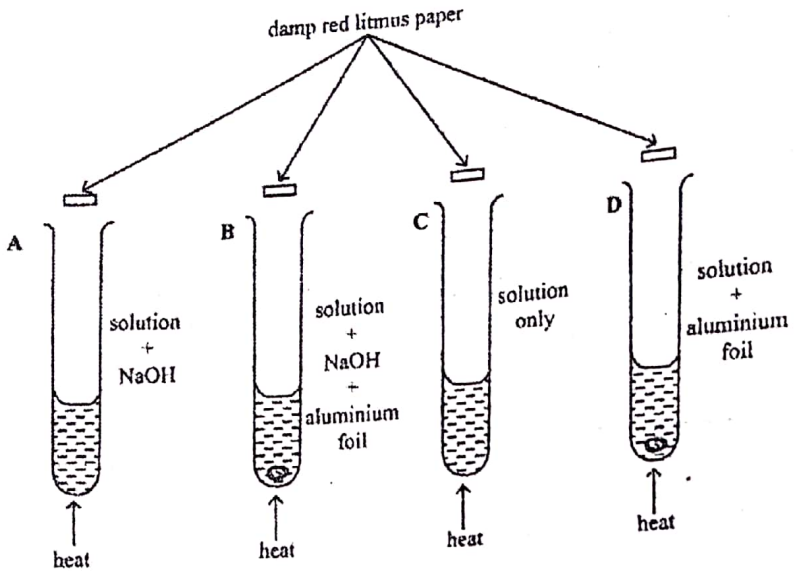
D a polymerisation reaction.

34. The diagrams show some energy profiles of different reactions.

Which diagram represents the reaction with the largest negative enthalpy change of reaction?



35. A solution of silver nitrate was placed in four different test tubes and subjected to different tests as shown in the diagram.



In which test tube will the red litmus paper change to blue?

36. Packaging material made of polyethene cannot be disposed of by land filling because it is

A poisonous to animals.

B non biodegradable.

C a condensation polymer.

D an addition polymer.

37. Which statement is true about the use of plants in traditional medicine?

A there are clear prescriptions and dosages

B they can improve the health of a person

C they are not poisonous

D they do not cause any allergies

38. Purity of a substance can be tested by

A crystallisation.

B chromatography.

C filtration.

D precipitation.

39. In the purification of water the coagulant used is

A aluminium sulphate.

B potassium sulphate.

C copper sulphate.

D barium sulphate.

40. Which statement correctly defines the term *mineral beneficiation*?

A exporting the ore for quick cash benefits

B using the ore to benefit the community

C processing ore to add value and fetch higher prices

D selling precious stones on the black market to benefit from the high prices

DATA SHEET
The Periodic Table of the Elements

Group I	Group II										Group III	Group IV	Group V	Group VI	Group VII	Group O
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) Number

The volume of one mole of any gas is 28 dm^3 at room temperature and pressure (r.t.p.)

1	C
2	C
3	B
4	D
5	B
6	C
7	C
8	D
9	B
10	B
11	A
12	C
13	A
14	A
15	C
16	A
17	D
18	B
19	A
20	C

21	C
22	D
23	D
24	D
25	B
26	D
27	A
28	C
29	D
30	A
31	C
32	B
33	A
34	C
35	B
36	B
37	B
38	B
39	A
40	C

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

4024/2

CHEMISTRY

PAPER 2 NOVEMBER 2019 SESSION 2 hours

Candidates answer on the question paper

Additional materials:
Electronic calculator

Time 2 hours

INSTRUCTIONS TO CANDIDATES
Write your name, centre number and candidate number in the spaces at the top of this page and centre and candidate number in the box on the top right corner of every page of this paper.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Section A
Answer **all** questions.
Write ycur answers in the spaces provided on the question paper.
Section B
Answer any **four** 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.

A copy of the periodic table is provided on **page 17**.

This question paper consists of 17 printed pages and 3 blank pages.

Section A

Answer **all** questions in the spaces provided

1. *Fig 1.1* shows a technique used in chemical analysis.

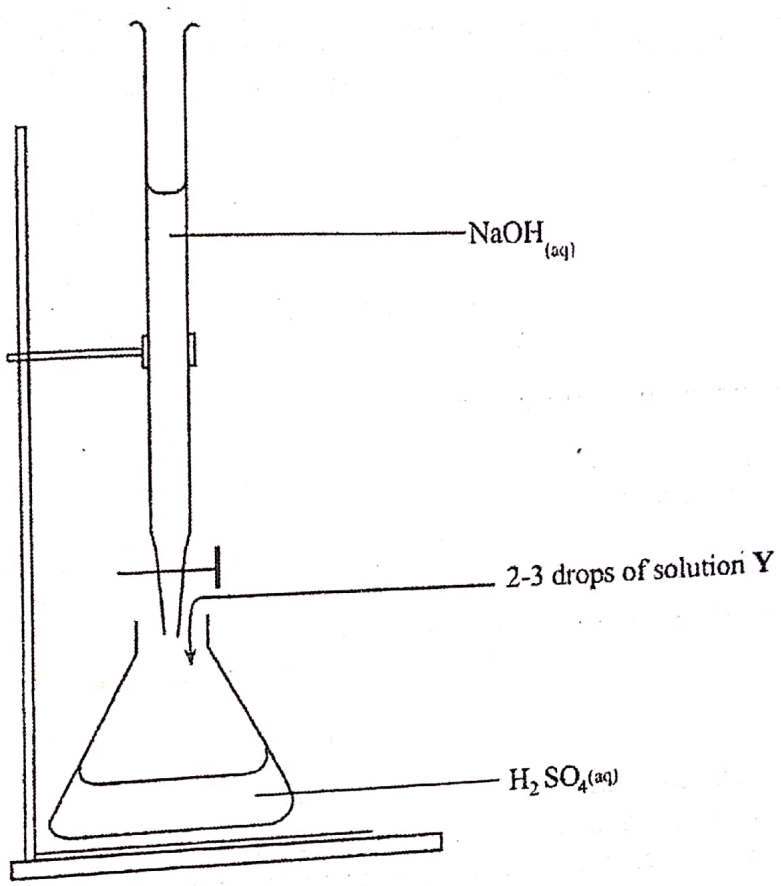


Fig 1.1

(a) (i) Name the technique shown in **Fig. 1.1.**

.....

[1]

(ii) State and explain the role of solution **Y**

role .....

explanation .....

.....[3]

(iii) Describe a chemical analysis that can be done using this technique.

.....

.....

[1]

(iv) Describe how pure crystals of the salt formed in the flask can be obtained.

.....

.....

.....

.....

.....

[3]

2. **(a)** Define the term

1. *atom*, ...

.....

2. *isotope*. .....

.....

[2]

(b) **Table 2.1** is an incomplete table showing the number of subatomic particles in the listed species.

Complete **Table 2.1** by indicating the correct number of particles in each species

Table 2.1

species	number of protons	number of electrons
Mg^{2+}	12	
N^{3-}	7	
S		16

[3]

(c) Draw a dot and cross diagram to show the bonding in magnesium nitride, Mg_3N_2.

[3]

3. (a) Chemical equations for two reactions, **X** and **Y**, are shown:

X: $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

Y: $Cl_{2\ (g)} + 2NaBr_{(aq)} \rightarrow 2NaCl_{(aq)} + Br_{2\ (l)}$

(i) Name the type of reaction

1. **X**, ...
2. **Y**. .....

[2]

(ii) Describe and explain, the effect of doubling the volume of hydrochloric acid in reaction **X**, given that 0.05 moles of each of the reactants were initially present.

effect .....

explanation .....

.....

.....

[2]

[2]

(b) **Fig 3.1** shows copper (II) nitrate being heated in a test tube.

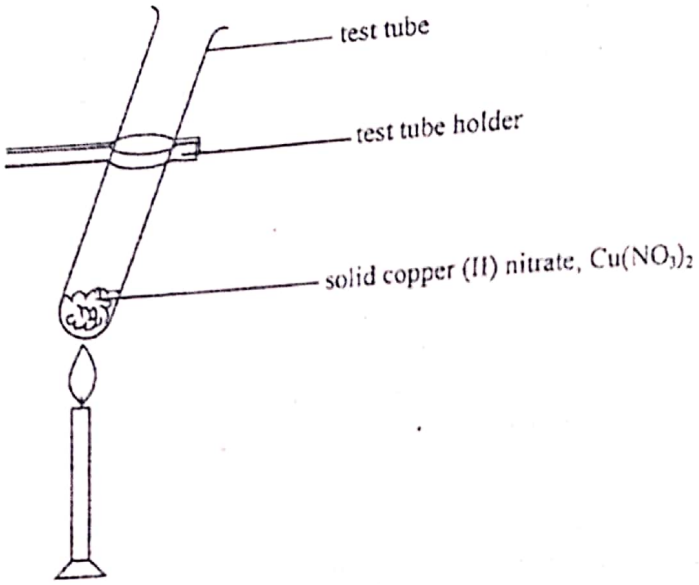


Fig 3.1

The chemical change that occurred can be represented by the equation

$$2Cu\,(NO_3)_{2\,(s)} \longrightarrow 2\,X_{(s)} + yNO_{2(g)} + O_{2(g)}$$

(i) Name product X

.....

[1]

(ii) Determine the value of the coefficient y.

[1]

(iii) Describe any observable change that occurred.

.....

.....

.....

4. (a) (i) State any **two** human activities that contribute to the emission CO_2 into the atmosphere. [2]

1 .....

2 .....

.....

(ii) Describe **two** environmental effects of high concentrations of CO_2 in the atmosphere. [2]

1 .....

.....

2 .....

.....

(iii) Explain any **two** ways that can be used to reduce the amount of CO_2 in the atmosphere. [2]

1 .....

.....

2 .....

.....

(b) Name **two** other gaseous pollutants that are emitted into the atmosphere.

1 .....

2 .....

[2]

5. (a) **Fig 5.1.** shows a set up of an investigation that was carried out in a laboratory.

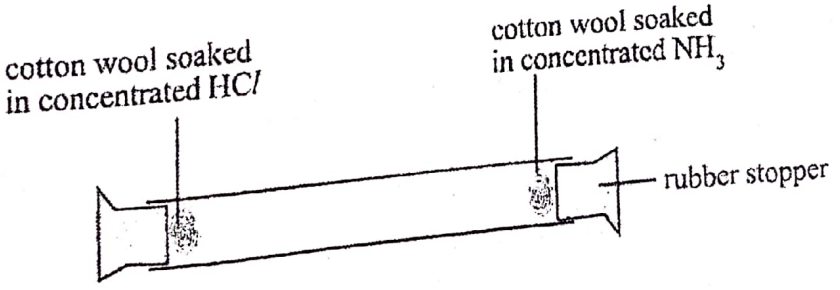


Fig 5.1

(i) Describe and explain the observable change that occurred.

observation .....

.....

explanation .....

.....

.....

[2]

(ii) Write a balanced chemical equation for the reaction that occurred.

[1]

(iii) State any **two** conditions that will affect the time taken for the change to be observed.

1 .....

2 .....

.....

[2]

(iv) State any **one** use of the product formed.

.....

.....

[1]

(b) Describe **two** causes of eutrophication.

.....

.....

.....

.....

[2]

Section B

Answer any **four** questions from this section in the spaces provided.

6. (a) (i) **Table 6.1** is an incomplete table showing materials used in the production of nitric acid.

Table 6.1

raw material	source(s)

Complete **Table 6.1** by naming the materials used in the production of nitric acid and stating their sources. [4]

(ii) State the conditions necessary for the production of nitric acid.

.....

.....

.....

[2]

(iii) Write the **three** equations involved in the production of nitric acid.

1 .....

2 .....

3 .....

[3]

(b) Calculate the oxidation state of sulphur in

1. H_2S, ...
2. H_2SO_4 .....

[2]

(c) (i) Write the chemical formula of ammonium nitrate.

.....

[1]

(c) (i) Write the chemical formula of ammonium nitrate.

.....

[1]

(ii) Name the three types of bonds in ammonium nitrate.

1. .....
2. .....
3. .....

[3]

7. (a) **Fig 7.1** shows a reaction of barium and some of its compounds.

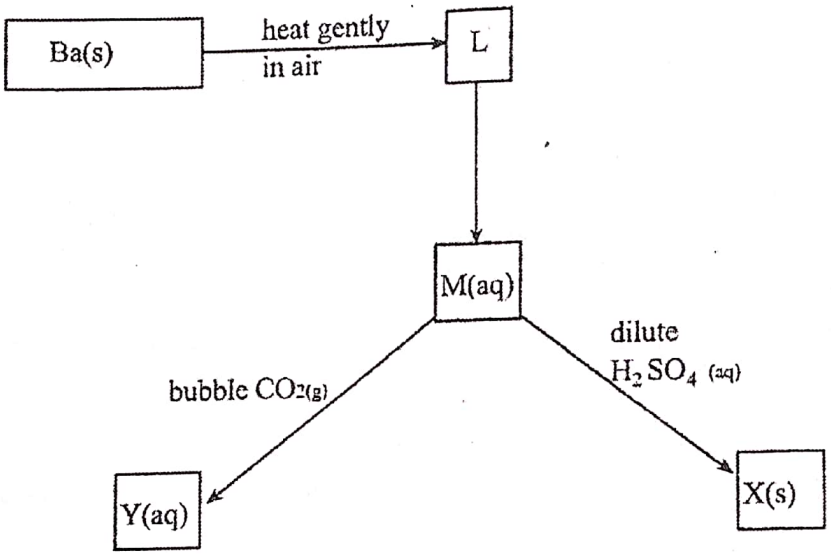


Fig. 7.1

(i) Identify compound

L, ...

M, ...

X, ...

Y. .....

[4]

(ii) Write balanced chemical equations for the formation of

1.M , ...

2. X, ...

3. Y. .....

[3]

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

.....

[2]

(c) A mass of 1.32 g of $CO_{2(g)}$ was collected when a sample of calcium carbonate was heated.

(i) Calculate the mass of calcium carbonate that was heated.

[3]

(ii) State any **three** uses of CaO.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

8. (a) A hydrocarbon **X** consists of 86% carbon and 14% hydrogen. The relative molecular mass of **X** is 56.

(i) Determine the molecular formula of **X**.

[5]

(ii) State, with a reason, the homologous series to which **X** belongs.

.....

.....

.....

[2]

(iii) Describe a chemical test that can be used to show the presence of **X**.

.....

.....

.....

.....

[2]

(b) **Table 8.1** is an incomplete table showing the alloys of copper and their composition.

Table 8.1

name of alloy	composition

Complete **Table 8.1** by naming the two alloys of copper and stating their composition.

[4]

(c) Describe the

1. biological importance of iron, ...
.....
.....
.....

2. industrial importance of iron. .....
.....
.....
.....
.....

[2]

9. (a) (i) Explain the term *hydrocarbon*.

.....
.....
.....

[2]

(ii) Name the process by which alkanes are obtained from petroleum.

.....

(b) Draw the structures of any **three** possible isomers of an alkane with six carbon atoms.

[3]

(c) Write the chemical equation for the complete combustion of propane.

.....

[2]

(d) (i) Methane reacts with chlorine in the presence of uv-light.
Draw the structural formula of the organic product formed.

[1]

(ii) Name this type of reaction.

.....

[1]

(e) (i) Ethanol is an organic compound that can be used to produce ethene and ethanoic acid as shown in **Fig 9.1**

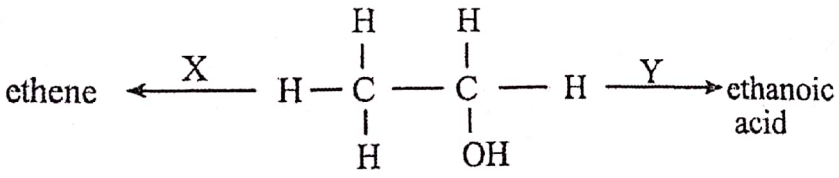


Fig 9.1

Name reagent

X, ...

Y. .....

[2]

(ii) State any one use of ethanol.

.....

.....

[1]

(iii) Draw one repeat unit of polyethene.

[1]

(iv) Draw a block diagram to show the structure of terylene

[1]

10. (a) (i) Name a suitable method of disposing

1. metallic waste, ...
2. bones from a canteen, ...
3. tree leaves. .....

[3]

(ii) Describe the challenges associated with disposal of plastic waste.

.....

.....

[2]

Candidate Number

(b) **Table 10.1** is an incomplete table showing some pollutants, their sources and their effects on the environment.

Complete **Table 10.1** by stating the source of the named pollutant and its effect on the environment.

Table 10.1

pollutant	source	environmental effect
carbon monoxide		
oxides of nitrogen		

[4]

(c) (i) Describe how the release of oxides of nitrogen in the atmosphere can be minimised.

.....

.....

.....

.....

[2]

(ii) Describe the causes of low pH in soils.

.....

.....

.....

.....

[2]

(iii) Write a balanced chemical equation to show how lime adjusts the pH of acidic soils.

[2]

ZIMBABWE SCHOOL EXAMINATION COUNCIL

General Certificate of Education Ordinary Level

EXPECTED ANSWERS

NOVEMBER 2019

4024/2

CHEMISTRY

1. (a) (i) -Titration/Volumetric Analysis/Quantitative Analysis

(ii) -to show the end point/ It acts as an indicator

-changes colour according to PH

(iii) -determine the amount of the analyte

(iv) -heat the mixture to form a saturated/concentrated solution
-cool the solution
-filter the solution
-dry the solution

---

2. (a) 1. -smallest part of an element that takes part in a chemical reaction

2. -an atom with the same number of protons/atomic number with other atom(s) of the same element but different mass number/number of neutrons.

(b)

Species	Number of Protons	Number of electrons
Mg^{2+}	12	10
N^{2-}	7	10
S	16	16

(c)

---

3. (a) (i) X – neutralisation/Acid Base
Y – Displacement/redox

(ii) - No effect on amount of product

-NaoH is the limiting agent/HCl is in excess

(b) (i) Copper (II) Oxide (CuO)

(ii) 4

(iii) -Brown fumes
-Black solid remains in test tube

(a) (i) -use of vehicles
-use of fuels for cooking
-veld fires

(ii) -Global warming
-Floods
-Drought

(iii) -Planting trees
-Reduced use of carbon based fuels
-use of electricity

(b) -SO_2
-SO_3
-Nitrogen Oxides
-CO

---

5. (a) (i) -a white powder/ring/fumes forms closer to the HCl
-HCl and NH_3 diffuses towards each other
-react to form NH_4Cl (white ring).
-Ammonia has greater rate of diffusion

(ii) $NH_3 + HCl \rightleftharpoons NH_4Cl$

(iii) -temperature
-amount of the gas/concentration
-size of the tube

(a) (i) -Ammonia
-Haber Process
-Oxygen
-Fractional distillation of liquid Air/Electrolysis of water

(ii) -Temperature : 900°C
-Catalyst: Platinum/Rhodium catalyst
-Pressure : 7-10atmospheres

(iii) Equation 1: $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$
Equation 2: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
Equation 3: $3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO_2(g)$

Equation 4: $4NO_2(g) + 2H_2O(l) + O_2(g) \rightarrow 4HNO_3(g)$

(b) -2
$+6$

(c) (i) NH_4NO_3

(ii) Covalent bonding
Dative/ Coordinate Bonding
Ionic/Electrovalent Bonding

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7. **(a) (i)** L: BaO
M: $Ba(OH)_2$
X: $BaSO_4$
Y: $BaCO_3$

(ii) $BaO_{(s)} + H_2O(l) \rightarrow Ba(OH)_{2(aq)}$
$Ba(OH)_{2(aq)} + H_2SO_{4(aq)} \rightarrow BaSO_{4(aq)} + H_2O(l)$
$Ba(OH)_{2(aq)} + CO_{2(g)} \rightarrow BaCO_{3(aq)} + H_2O(l)$

(b) $Mg_{(s)} + H_2O_{(g)} \rightarrow 2MgO_{(s)} + H_{2(g)}$

(c) (i) $n(CO_2) = n(CaCO_3)$

$= \frac{1.32g}{44gmol^{-1}}$

$= 0.03moles$

$m(CaCO_3) = 0.03mol \times 100gmol^{-1}$

$= \mathbf{3g}$

(ii) -neutralise acidic soils
-makes mortar that hold bricks
-remove impurities in the molten iron

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8. **(a)** **(i)**

Carbon	Hydrogen
$\frac{86}{12}$	$\frac{14}{1}$
1	**2**

CH_2

$14x = 56$

$x = 4$

C_4H_8

(ii) -alkenes
-Unsaturated

(iii) -reaction with aqueous bromine
-decolourised

(b) -Bronze - tin and copper
-Brass - zinc and copper

(c) **1.** -part of haemoglobin/transport of oxygen/formation of haemoglobin
2. -catalyst in reactions

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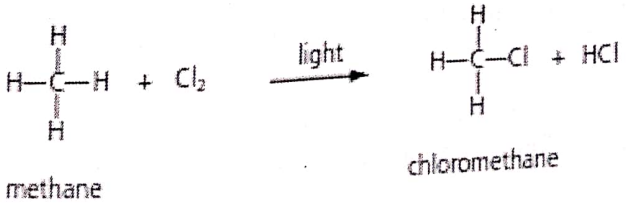
9. **(a)** **(i)** -A hydrocarbon is a compound made up of the elements carbon and hydrogen only.

(ii) -Fractional distillation

(b) -hexane
-2 methyl pentane / 3 methyl pentane
-2,3 dimethyl butane/ 2.2 dimethyl butane

(c) $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O$

(d) **(i)** chloromethane



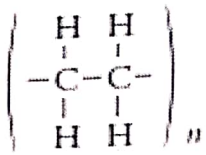
methane chloromethane

(ii) Free radical substitution

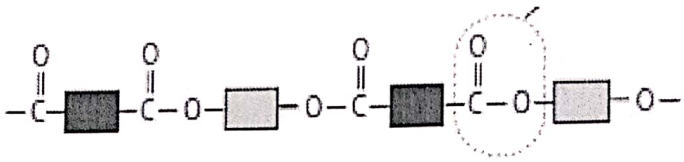
(e) (i) X: Concentrated H_2SO_4/ Al_2O_3
Y: $Cr_2O_7{}^{2-}$/ permanganate ion

(ii) -fuel
-solvent
-alcoholic beverages
-medical purposes

(iii)



(iv)



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10. (a) (i) -recycling
-burning (incineration)
-burying

(ii) -Plastic is non biodegradable, hence burning it causes air pollution.

(b)

Pollutant	Source	Environmental effect
Carbon monoxide	-incomplete combustion	-poisonous/toxic
Oxides of Nitrogen	-contributes to acid rain	-destroys ozone layer -soil acidity increases

(c) (i) -controlled use of combustion appliances
-catalytic convertors in cars

(ii) -Acid rain
-Excessive use of nitrogen based fertilisers

-improper disposal of heavy metals

(iii) $CaO_{(s)} + 2H^{+}{}_{(aq)} \rightarrow Ca^{2+}{}_{(aq)} + H_2O_{(l)}/Ca(OH)_{2(s)}$