For Performance Measurement

Zimbabwe School Examinations Council

GENERAL CERTIFICATE OF EDUCATION
ORDINARY LEVEL

5071

CHEMISTRY

Past Question Papers and Expected Answers

NOVEMBER 2017

Candidate Name | Centre Number | Candidate Number

001761

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/2

PAPER 2 Theory

NOVEMBER 2010 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 lined pages provided and, if necessary, continue on separate answer paper.

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

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 12.

FOR EXAMINER'S USE	
Section A	—
1	
2	
3	
4	
5	

This paper consists of 12 printed pages.

Section A

Answer all the questions in the spaces provided.

The total mark for this section is 45.

For Examiner's Use

1 Table 1 shows the electronic arrangements of seven elements, A to G.

Table 1

Element	Electronic arrangement
A	2,1
B	2,6
C	2,8
D	2,8,1
E	2,8,6
F	2,8,7
G	2,8,8,1

(a) Give the letters for the following:

(i) two elements in the same group of the periodic table

_____ and _____ [1]

(ii) two elements in the same period of the periodic table

_____ and _____ [1]

(iii) an element which forms a positive ion

_____ [1]

(iv) a noble gas

_____ [1]

2

For Examiner's Use

(v) a halogen

_____ [1]

(vi) a non metal

_____ [1]

(b) (i) Name the type of bonding formed between elements B and G

_____ [1]

(ii) Draw a dot and cross diagram to show the arrangement of electrons in the compound formed when an atom of B combines with two atoms of hydrogen. [2]

(iii) Name the compound formed in (ii).

_____ [1]

[Total: 10]

For Examiner's Use

2 (a) Define the term *relative molecular mass*.

_____

_____

_____

_____ [2]

(b) (i) Give the formula of ammonium sulphate.

_____ [1]

(ii) Hence calculate the relative molecular mass of ammonium sulphate.

[1]

(iii) Giving a reason for your answer state one use of ammonium sulphate.

Use _____ [1]

Reason _____ [1]

(iv) Give the name and test for the gas which would be produced when ammonium sulphate is heated with an alkali.

name of gas: _____ [1]

test for gas: _____

_____

_____

_____ [2]

[Total: 9]

4

3 Fig 3 shows the apparatus used to pass an electric current through concentrated hydrochloric acid.

For Examiner's Use

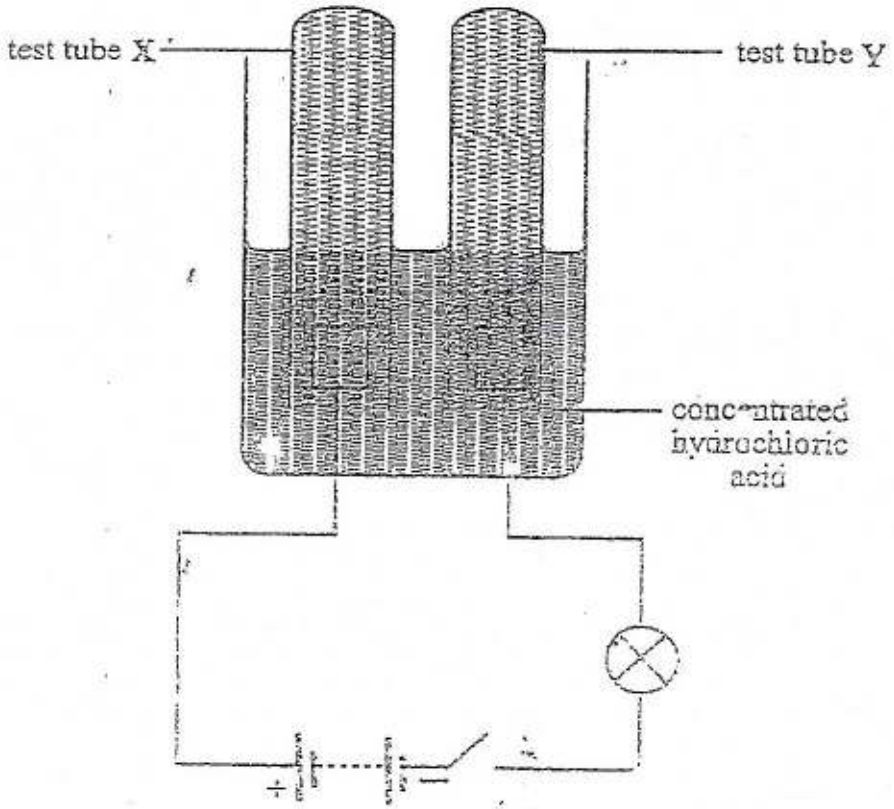


Fig 3

(a) What is the name given to this process?

_____ [1]

(b) State one observation made when the current is switched on.

_____

_____

_____ [1]

(c) Name the gases that would be collected in X and Y.

X _____

Y _____ [2]

For Examiner's Use

(d) Give the anode and cathode reactions.

anode reaction _____

cathode reaction _____ [2]

(e) Describe a test for the product at the negative electrode (cathode)

Test _____

Result _____ [2]

[Total :8]

4 Cobalt (II) chloride crystals contain water of crystallisation. The formula can be written as $CoCl_2 \cdot nH_2O$.

In an experiment to find n, a sample of the crystals were weighed and then gently heated to remove all the water. The remaining powder was then weighed. The results were recorded in Table 2.

Table 2

Mass of crystals	47.6g
Mass of remaining powder	26.0g

(a) Calculate

(i) The mass of the water driven off by the heat,

mass of water = _____

(ii) The number of moles of water driven off by the heat,

number of moles = _____

6

(iii) The number of moles of cobalt (II) chloride, $CoCl_2$ that remained.

For Examiner's Use

number of moles = _____ [3]

(b) Determine the value of n in the formula $CoCl_2 \cdot nH_2O$.

_____

_____

_____ [2]

(c) What colour changes occur when water is added to anhydrous cobalt (II) chloride?

_____

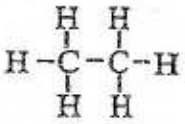
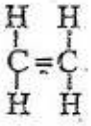
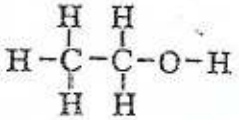
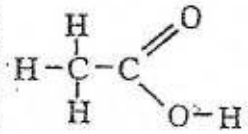
_____ [2]

[Total :7]

5 Table 3 shows organic compounds A, B, C and D.

For Examiner's Use

Table 3

compound	structure of compound	Type of compound
A		----------
B		----------
C		----------
D		----------

(a) Complete the table by naming the types of organic compounds shown. [4]

(b) Write the molecular formula of A

_____ [1]

(c) Name the atoms present in the functional group of C.

_____ and _____ [2]

(d) Which compounds are hydrocarbons?

_____ and _____ [2]

(e) Which compound is unsaturated?

_____ [1]

(f) Which compound can form addition polymers?

_____ [1]

[Total :11]

For Examiner's Use

9 5

Section B

Answer any three questions from this section.

6 (a) Define a *macromolecule*. [1]

(b) (i) By using simple block diagrams, give the monomers for nylon and terylene.

(ii) Name the linkages formed between the monomers when nylon and terylene are formed. [6]

(c) Give **one** difference between condensation and addition polymerisation. [1]

(d) Give **one** example of an addition polymer and its use. [2]

[Total 10]

7 (a) (i) Define an *alloy*. [1]

(ii) State **two** reasons why alloys are often used in preference to pure metals. [2]

(iii) Give **one** example of an alloy, its composition and use. [3]

(b) When strips of aluminium and iron are left in moist air for a week, the aluminium remains relatively shiny, whereas iron becomes coated with a reddish brown solid.

(i) Briefly explain the difference between the appearance of the aluminium and iron. [2]

(ii) Explain in terms of redox, what has happened to the iron. [2]

[Total :10]

8 (a) Define *reduction* in terms of

(i) hydrogen,

(ii) electron transfer,

(iii) change in oxidation number (state). [3]

(b) In the equations given below, state whether the underlined substance had been *oxidised* or *reduced*. Give a reason for your answer.

(i) $CuO(s) + \underline{H_2}(g) \longrightarrow H_2O(g) + Cu(s)$.

(ii) $Cl_2(aq) + \underline{2Br^-}(aq) \longrightarrow Br_2(g) + 2Cl^-(aq)$

(iii) $\underline{2CO}(g) + O_2(g) \longrightarrow 2CO_2(g)$ [6]

(c) Give the colour changes involved in reaction **b(ii)**. [1]

[Total: 10]

9 The speed of the reaction between 10g of calcium carbonate and hydrochloric acid can be determined by recording the volume of gas produced at regular *time intervals*.

(a) Write a balanced chemical equation of the reaction between calcium carbonate and hydrochloric acid. [1]

(b) (i) Draw a diagram of the apparatus one would use to collect and measure the volume of the gas. [2]

(ii) What other essential piece of apparatus is required in this experiment? [1]

(iii) Describe how you would test for the gas produced? [2]

(c) Calculate the volume of the gas produced at r.t.p. [3]

(d) Suggest one method which may be used to increase the speed of this reaction. [1]

[Total :10]

DATA SHEET
The Periodic Table of the Elements

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

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

*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.)

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2010

CHEMISTRY 5071/2

15

7

1 (a) (i) ADG or B and E; (1)

(ii) ABC or DEF; (1)

(iii) A or D or G; (1)

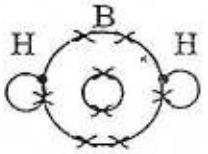
(iv) C; (1)

(v) F; (1)

(vi) B or C or E or F; (1)

(b) (i) ionic/ electrovalent; (1)

(ii)



(2)

(iii) water (1)

2 (a) The relative molecular mass of substance is the average mass of a molecule of the element of compound (1) relative to that of the mass of an atom of $^{12}_{6}C$ which is taken as 12 units. (2)

(b) (i) $(NH_4)_2SO_4$ (1)

(ii) 28 + 8 + 32 + 64/132 (1)

(iii) Use : Fertiliser (1)
Reason : ammonium sulphate contains nitrogen which is one of the vital elements for plant nutrition. (1)

(iv) gas: ammonia (1)

test : gas turns damp red litmus paper blue (2)

3 (a) electrolysis (1)

(b) Bubbles of gas are seen at both anode and cathode/liquid level goes down /gases collect in the two test tubes; (1)

(c) X is chlorine Y is hydrogen ; (2)

(d) Cathode: $2H^+ + 2e \longrightarrow H_2$
Anode: $2Cl^- - 2e \longrightarrow Cl_2$ (1)

(e) Test: Put a burning splint in a jar of the gas

result : burns with a pop sound (2

4 (a) (i) 47.6 – 26.0/21.6 (1)

(ii) $\frac{21.6}{18}$/1.2 (1)

(iii) $\frac{26^{*}}{130}$/0.2 (1)

(b) $\frac{1.2}{0.2}$;6 (1)

6 (1)

(c) blue ; to pink ; (2)

5 (a) A alkane;
B alkene;
C alcohol;
D carboxylic acid; (4)

(b) C_2H_6; (1)

(c) oxygen;hydrogen (2)

(d) A; (1)
B; (1)

(e) B; (1)

(f) B; (1)

6 (a)— A macromolecule is a large molecule. (1)

(b)

Nylon	Terylene
Monomers HOOC–⬡–COOH H_2N–□–N H_2 [2]	Monomers HOOC–⬡–COOH HO–□– OH [2]
Linkage amide [I]	Linkage ester [I]

15 8

(c) Condensation polymerisation | addition polymerisation

1. water or small molecule is removed during the reaction | 1. No water or small/ nolecule is removed

2. involves saturated compounds | 2. Involves unsaturated compounds. (1)

(d)

Addition Polymer	Use
polythene	plastic bags
polystrene	packaging
PVC	pipes etc (2)

7 (a) (i) Alloy – a mixture of metals/a mixture of metals and non metals (1)

(ii) improved physical properties e.g. hardness, tensile strength, corrosion resistance more attractive (2)

(iii)

Alloy	Composition	Use
stainless steel	iron, carbon, chromium	cutlery and cooking utensils
brass	copper, zinc	musical instruments, décor
bronze	copper, tin	making coins and metals
solder	tin, lead	joining pieces of metals

(3)

(b) (i) Aluminium is unreactive due to the Al_2O_3 layer on its surface; iron has rusted and formed the red-brown solid; (2)

(ii) iron has been oxidised/iron has lost 3 electrons/ $Fe - 3e \longrightarrow Fe^{3+}$/iron has combine with oxygen; to form iron (III) oxide/rust; (2)

Total [10]

8 (a) (i) addition of hydrogen;

(ii) loss of electrons;

(iii) decrease in oxidation number/state; (3)

(b) (i) H_2 is oxidised;
the oxidation state of hydrogen increased from 0 to +1/oxygen is added to H_2; (1)

(ii) Br^- is oxidised;
Br^- lost an electron/ Br^- increased its oxidation state from – 1 to 0; (1)

(iii) CO is oxidised; (1)
oxygen has been added/carbon has increased its oxidation state from +2 to + 4; (1)

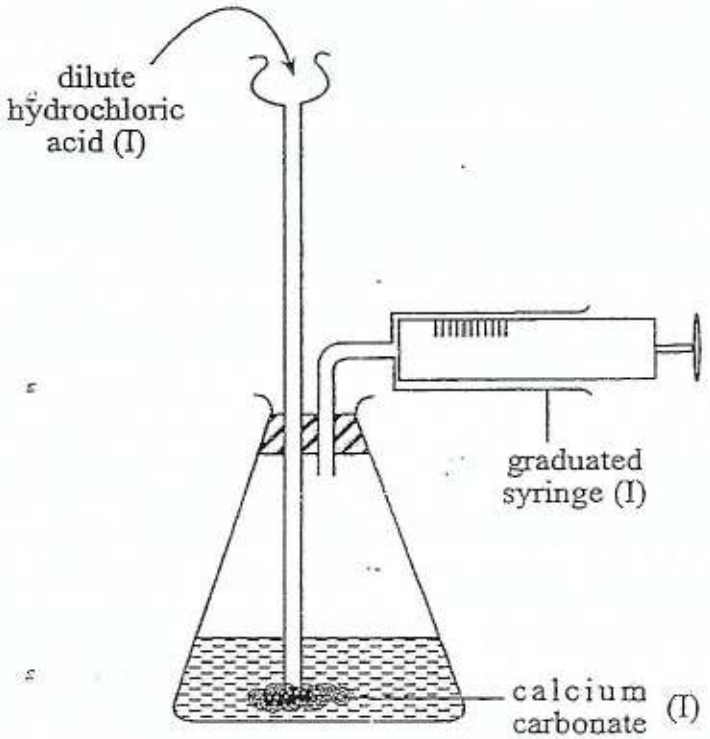
(c) colourless solution changes to a reddish-brown solution (1)

Total [10]

9 (a) $CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O$

correct products (1)
balancing (1) 2 max 1

(b) (i)



(ii) stop watch/clock (1)

(iii) bubble gas in limewater; (1)
limewater turns milky; (1)

(c) Moles of $CaCO_3 = \frac{10}{100}$ /0.1 *mol*; (1)

17

9

∴ moles of $CO_2 = 0.1$ mol; (1)
volume of $CO_2 = 28 \times 0.1/2.8 dm^3$; (1)

(d) heating the mixture/crushing the calcium carbonate/using a more concentrated acid; (1)

Total [10]

1 K

Candidate Name | Centre Number | Candidate Number

000006

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/3

PAPER 3 Practical Test

NOVEMBER 2010 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculators

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results 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.
Qualitative analysis notes for this paper are printed on page 6.

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 6 printed pages and 2 blank pages.

[Turn over

14 10

1 M is 28.6 $g\ dm^{-3}$ aqueous sodium carbonate, $Na_2CO_3 \cdot xH_2O$
N is 0.24 $mol\ dm^{-3}$ hydrochloric acid.

You are required to determine the value of x in $Na_2CO_3 \cdot xH_2O$.

Place solution N into a burrette.

Pipette 25.0 cm^3 of M into a conical flask. Titrate with N using methyl orange indicator.

Record your results in **table 1**.

Repeat the titration as many times as you consider necessary to obtain accurate results.

Table 1

Titration number	1	2	3	
Final burette reading /cm^3				
Initial burette reading /cm^3				
Volume of N used /cm^3				

[15]

Summary

25.0 cm^3 of M required ..... cm^3 of N for complete neutralisation.

Show which titration results you used to obtain the volume of N by placing a tick under the chosen reading.

20

For Examiner's Use

(a) Hydrochloric acid reacts with sodium carbonate according to the equation

$$Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}.$$

(i) Calculate the number of moles of hydrochloric acid in the volume of N used in titration.

[1]

(ii) Deduce the number of moles of sodium carbonate that neutralises the acid.

[1]

(b) (i) Calculate the mass of sodium carbonate used up in 25.0 cm^3 of M. [A_r :Na = 23, C = 12, O = 16]

[1]

(ii) Deduce the mass of sodium carbonate in 1 dm^3 of M.

[1]

(c) Calculate mass of water of crystallisation in 1 dm^3 of M.
[A_r: H = 1; O = 16]

[1]

(d) Calculate the value of x in the formula $NaCO_3 \cdot xH_2O$.

[1]

Total [21]

2 Carry out the following tests on substance C. Test and identify any gases given out.

Table of results

Test	Observations [12]	Deductions [5]
1. Strongly heat a portion of C in a hard glass tube		
2(a) Dissolve C in dilute nitric acid and divide solution into 2 portions.		
b(i) To the first portion add aqueous sodium hydroxide until in excess.		
(ii) To the second portion add aqueous ammonia until in excess		

Conclusion:

The cation present in C is _____ [1]

The anion present is _____ [1]

23

QUALITATIVE ANALYSIS NOTES (5071/3)

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid then add aqueous barium nitrate.	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess a colourless solution	white ppt., insoluble in excess giving
ammonium (NH_4^+)	ammonia produced on warming	
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron (II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron (III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Tests for gases

gas	*test and result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint
sulphur dioxide (SO_2)	turns aqueous potassium dichromate (VI) from orange to green

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2010

CHEMISTRY 5071/3

25

13

1 (a) Burette readings to 1 d.p. in correct places [1]

Ticking correctly, summary titre [1]

Sufficient number of titrations i.e. any two titres differing by 0,2 cm^3 [1]

Accuracy

Compare the candidate's result to that of supervisor and award accuracy below.

	Accuracy Marks
Mark	Difference from Supervisor
12	up to 0,20
11	0,20⁺ to 0,30
10	0,30⁺ to 0,40
9	0,40⁺ to 0,50
8	0,50⁺ to 0,60
7	0,60⁺ to 0,70
6	0,70⁺ to 0,80
5	0,80⁺ to 0,90
4	0,90⁺ to 1,00
3	1,00⁺ to 1,50
2	1,50⁺ to 2,00
1	2,00⁺ to 3,00
0	Greater than 3,00

(i) $0{,}24 \times \frac{\text{titre}}{1000}$ [1]

(ii) $\frac{\text{Ans to(i)}}{2}$ [1]

(b) (i) Answer to (ii) x 106 [1]

(ii) $106 \times \frac{1000}{25}$ [1]

(c) 28.6g – Answer to (b iv) [1]

(d) $\frac{\text{Answer to 1}}{18}$ [1]

2

Observation [12]	Conclusion [5]	
Carbon dioxide gas produced (1) turns lime water milky (1)	CO_3^{2-} ions (1)	
(a) - Effervescence (1) - carbon dioxide gas evolved (1) - turns limewater milky (1) - colourless solution (1)	CO_3^{2-} ions [1]	
(b)(i) - white (1) ppt-produced - soluble in excess (1)	Al^{3+} (1) Zn^{2+}(1)	
(ii) - white (1) ppt (1) produced -soluble in excess (1)	Zn^{2+} confirmed (1)	

Conclusion

The cation present in C is Zn^{2+} (1)

The anion present in C is CO_3^{2-} (1)

[Total: 19]

27

Candidate Name | Centre Number | Candidate Number

000007

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/4

PAPER 4 Alternative to Practical

NOVEMBER 2010 1 hour

Candidates answer on the question paper.
Additional materials:
Mathematical tables and/or Electronic calculators
Ruler

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

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Answer **all** questions.
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INFORMATION FOR CANDIDATES

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FOR EXAMINER'S USE		
1		
2		
3		
4		
5		
6		

This question paper consists of 14 printed pages and 2 blank pages.

24 15

1 A flask containing dilute hydrochloric acid was placed on a digital balance. An excess of calcium carbonate granules were added into the flask. A plug of cotton wool was quickly placed in the neck of the flask. The initial mass was then recorded.

For Examiner Use

(a) (i) Draw a diagram to show the set up for this experiment.

[2]

(ii) State the purpose of the cotton wool plug?

[1]

(b) Write a balanced equation for the reaction.

HCl + C

[2]

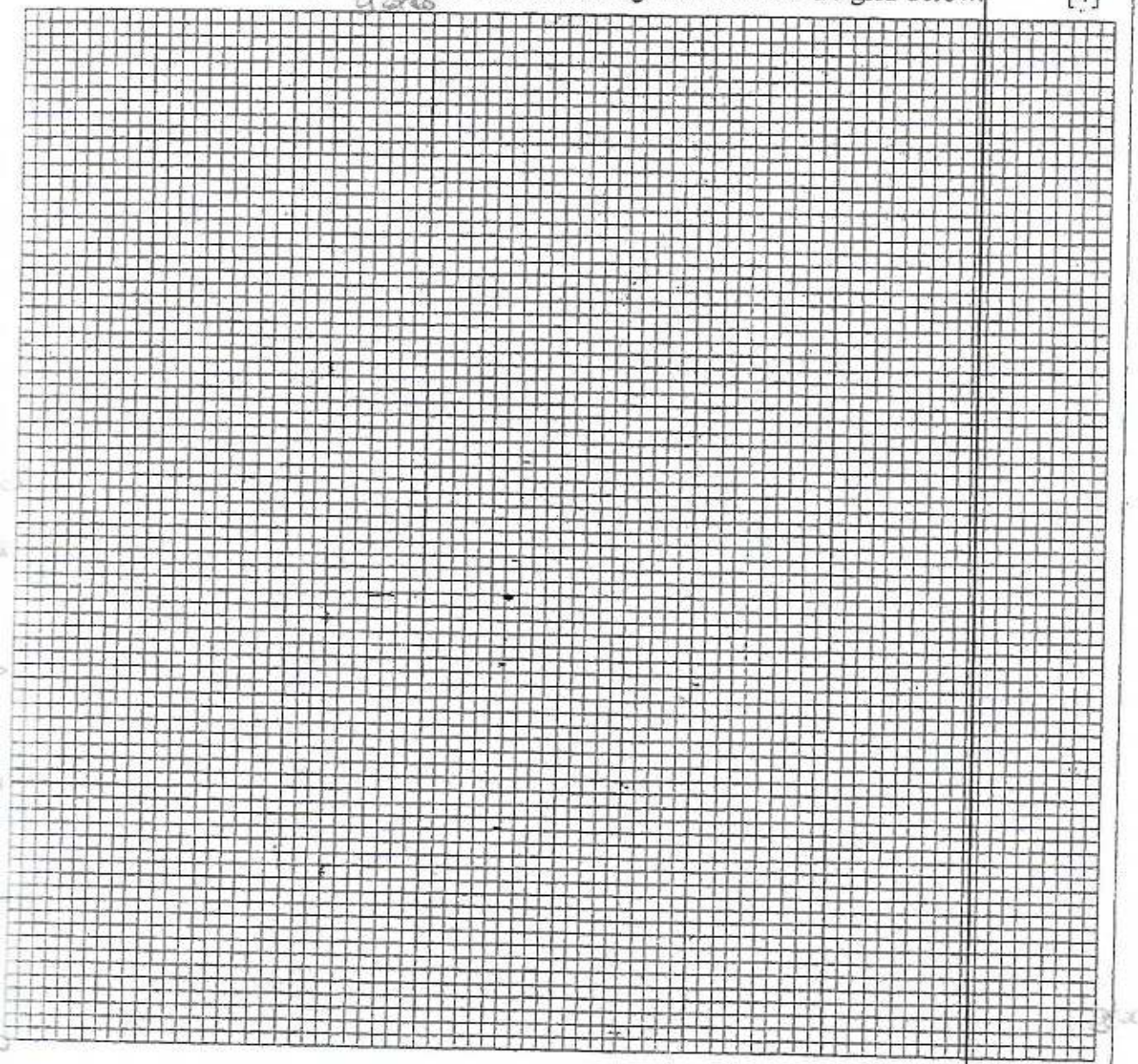
(c) (i) At the end of the experiment the loss in mass of the apparatus was calculated. The results obtained are shown in the **Table 1**.

Table 1

Time/Minutes	0	2	4	6	8	10	12	14	16	18
Loss in Mass/g	0	2.1	3.0	3.1	3.6	3.8	3.9	4.0	4.0	4.0

For Examiner's Use

Plot a graph of loss in mass against time on the grid below. [4]



(ii) Which results were incorrect? Explain.

_____

_____ [2]

(d) From the graph, determine

(i) the time the reaction stopped,

_____

_____

(ii) the loss in mass at five minutes.

_____

_____ [1]

(e) Explain why the mass of the flask and its contents decreased?

_____

_____ [1]

(f) On the same axis, draw a graph to show the results that woud be obtained by using the same mass of powdered calcium carbonate. [1]

[Total : 14]

2 A known mass of sodium hydroxide was dissolved in 250 cm^3 of distilled water. The mass of the sodium hydroxide was determined using apparatus shown in **Fig .1**.

For Examiner's Use

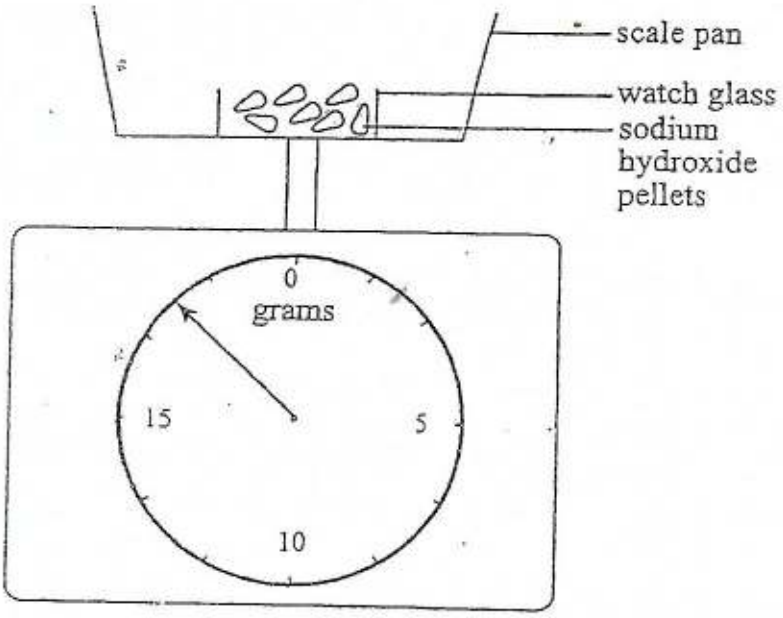


Fig. 1

(a) State the reading on the scale?

_____ [1]

(b) Given that the mass of the watch glass was 1.5g, calculate the mass of the sodium hydroxide used?

mass of sodium hydroxide = _____ [1]

(c) Calculate the number of moles of sodium hydroxide used.
(Ar. Na: 23; O:16; H:1)

number of moles = _____ [2]

23

(d) Calculate the concentration of the sodium hydroxide solution in $mol\ dm^{-3}$.

concentration of sodium hydroxide = _____ [2]

[Total : 6]

3 The apparatus to determine the empirical formula of magnesium oxide was set up as shown in Fig. 2.

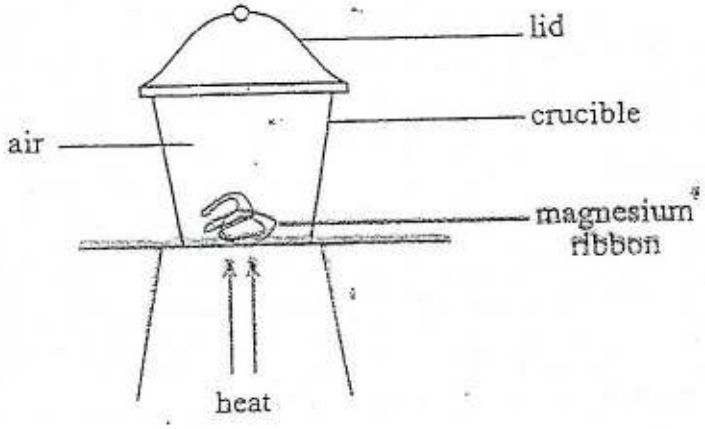


Fig. 2

Heat was applied strongly for a few minutes until all the magnesium had been converted into magnesium oxide. The following results were obtained.

Mass of crucible and lid = 25.1g
Mass of crucible; lid and magnesium ribbon = 27.5g
Mass of crucible; lid and magnesium oxide = 29.1g

(a) Calculate

(i) mass of magnesium ribbon

mass = _____ [1]

(ii) mass of magnesium oxide formed.

mass = _____ [1]

For Examiner's Use

(iii) mass of oxygen in the magnesium oxide formed,

mass = _____ [1]

(iv) empirical formula of the magnesium oxide.

[2]

(b) Expalin why the lid was slightly lifted from time to time during the experiment?

_____

_____ [1]

(c) How would you tell that all the magnesium had been oxidised?

_____

_____ [1]

[Total : 7]

4 Metals A, B and C were added to with water and steam respectively. Observations made are shown in **Table 2**.

Table 2

Metal	Observations
A	no reaction with water or steam
B	reacts vigorously with water liberating a colourless gas and an alkali
C	reacts violently with steam, giving a bright flame and white ashes

(a) Arrange the metals A, B and C in order of decreasing reactivity.

_____

_____ [2]

(b) Name the gas produced when metal B reacts with water and describe a chemical test for the gas.

_____

_____

_____

_____ [3]

[Total : 5]

5 An experiment was carried out to determine the concentration of an acid, H_2SO_4, by titration. 25.0 cm^3 of 0.1 $mol\ dm^{-3}$ sodium hydroxide was placed in a conical flask and mixed with three to five drops of methyl orange indicator.

For Examiner's Use

(a) Name the apparatus used for measuring the volume of sodium hydroxide.

[1]

A burette was filled with a solution of H_2SO_4 and run into the conical flask until the end point was reached.

Fig. 3 below shows the volume of H_2SO_4 used in three separate experiments.

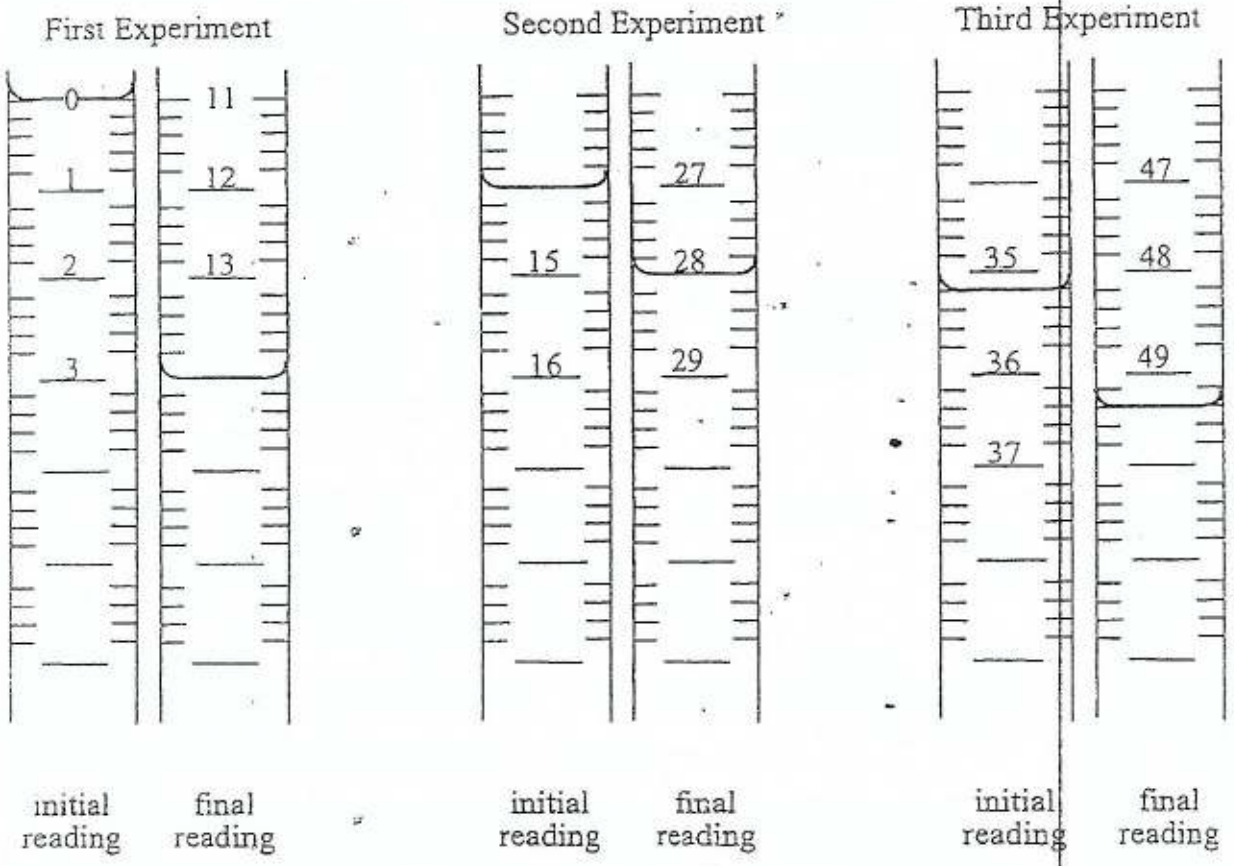


Fig. 3

37

(b) Record the results in the table 2.

Table 2

Experiment	1	2	3
Final burette reading/cm^3			
Initial burette reading/cm^3			
Volume of H_2SO_4 used/cm^3			

Tick the best titration results.

Summary

25.0 cm^3 of solution hydroxide-required _____ cm^3 of H_2SO_4. [8]

(c) Write a balanced equation for reaction between sodium hydroxide and H_2SO_4.

_____

_____ [2]

(d) (i) How many moles are in 25.0 cm^3 of 0.1 mol/dm^3 sodium hydroxide?

[1]

(e) How many moles of H_2SO_4 are in the average volume that reacts with 25.0 cm^3 of sodium hydroxide?

[1]

(f) (i) Calculate the concentration of H_2SO_4 in $mol dm^{-3}$.

[1]

35

(ii) Express the concentration of H_2SO_4 in gdm^{-3}.
(Mr, H_2SO_4 =98).

For Examiner's Use

[1]

[Total: 15]

6 Fig. 4 shows apparatus used to determine the heat produced when 1.0 $mol\ dm^{-3}$ dilute hydrochloric acid reacts with 1.5 $mol\ dm^{-3}$ sodium hydroxide.

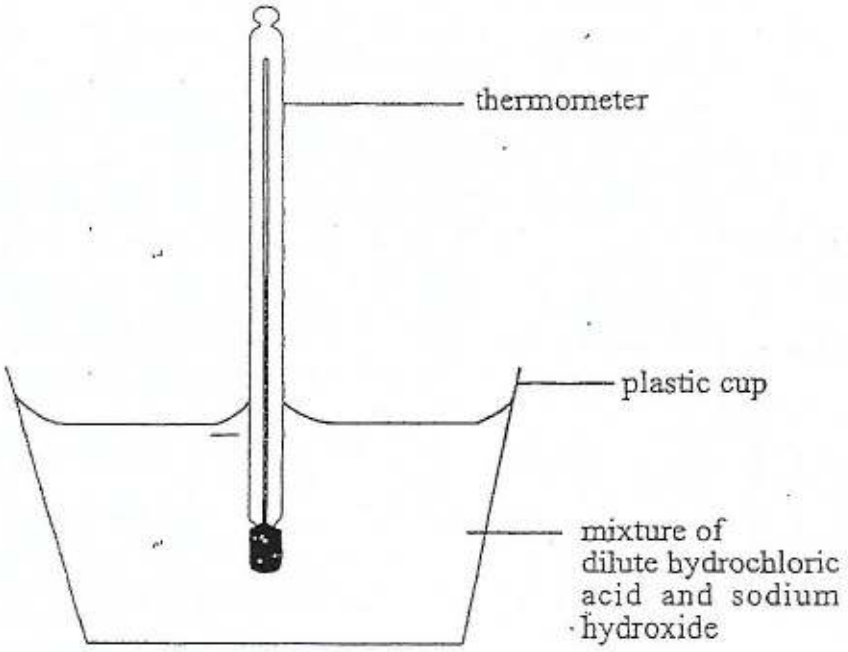


Fig. 4

(a) Suggest an advantage of using a plastic cup in the experiment.

[1]

(b) The same volume of dilute hydrochloric acid was mixed with different volumes of sodium hydroxide. The initial and final temperatures of the reaction mixtures are shown in Fig 5.

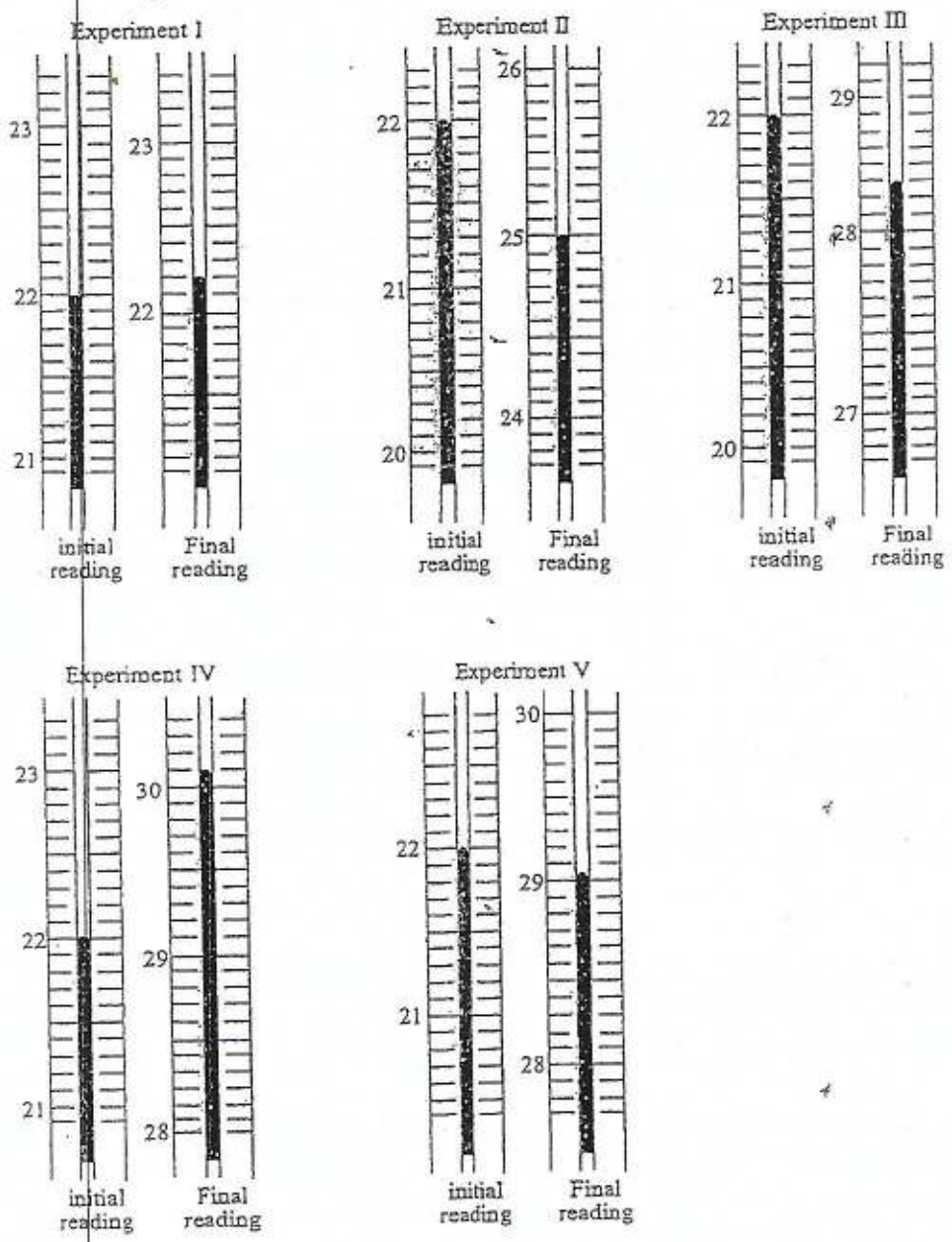


Fig. 5

The results were recorded in the Table 3.

Table 3

Experiment	Volume of hydrochloric acid/cm^3	Volume of sodium hydroxide/cm^3	Initial temperature /°C	Final temperature /°C	Change in temperature /°C
1	45.0	0.0	22.0	22.2	
2	45.0	10.0			
3	45.0	20.0			
4	45.0	30.0			
5	45.0	40.0			
6	45.0	50.0	22.0	29.0	

For Examiner's Use

Complete table 3. [5]

(c) (i) Write a balanced equation for the reaction between dilute hydrochloric acid and sodium hydroxide.

_____

_____ [2]

(ii) Name this type of reaction?

_____ [1]

(d) Calculate the number of moles in 45.0 cm^3 of 1.0-$mol\ dm^{-3}$ hydrochloric acid.

[1]

41

(e) How many moles of sodium hydroxide completely reacted with 45.0 cm^3 of dilute hydrochloric acid?

_____

_____

_____ [1]

(f) (i) State the experiment that gave the highest temperature change?

_____

_____ [1]

(ii) Calculate the heat energy produced by the reaction.
(Heat produced = total volume of solution x 4.3 J°x highest temperature change).

Heat energy = _____ [2]

(g) Suggest why the final temperature of the reaction mixture decreased in experiments 5 and 6.

_____

_____ [1]

(h) Identify one source of error in this experiment.

_____

_____ [1]

[Total: 16]

U2

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

—

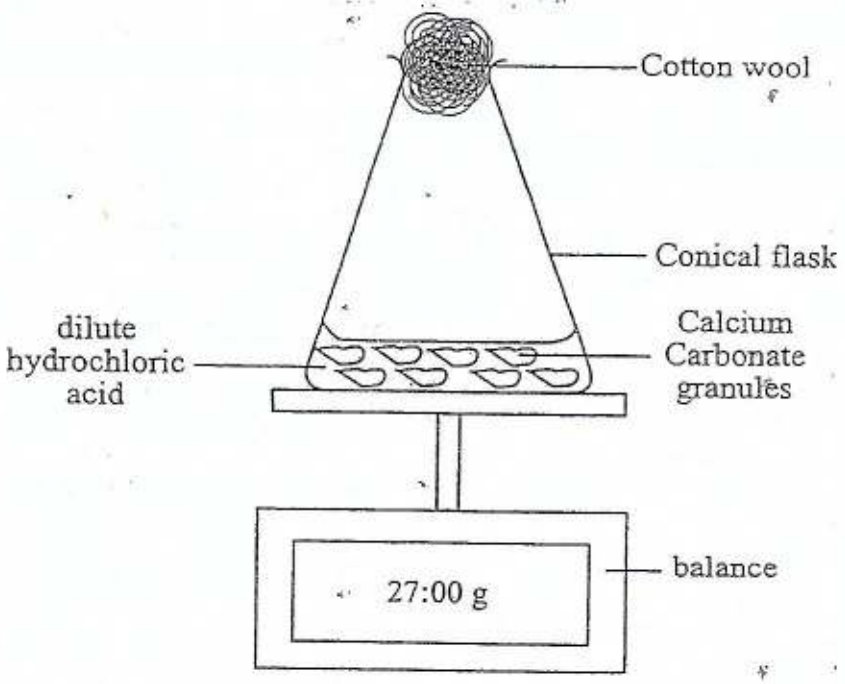
NOVEMBER 2010

CHEMISTRY 5071/4

43

20

1 (a) (i)



(i) correct diagram [1]

any two correct labels [1]

any four correct labels [2]

[4 max 2]

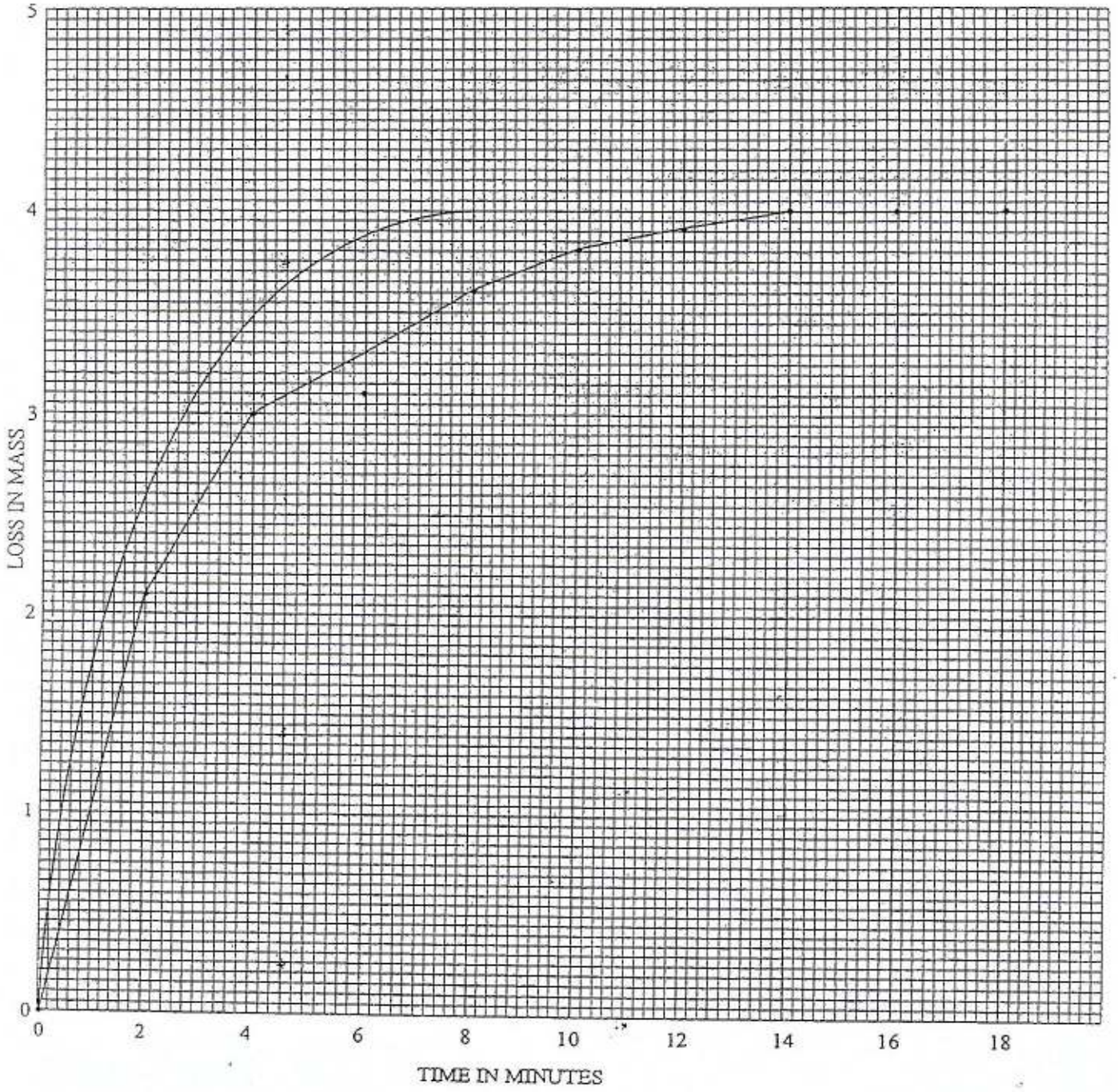
(ii) Allows carbon dioxide gas produced to escape; [1]

(b) $CaCO_{3(s)} + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(aq) + CO_{2(g)} + H_2O_{(l)}$ [2]

correct formular;
balanced equation;

44

(c) (i) On the graph paper – plotted points = 1mark labelled Axis = 1 mark
scale = 1mark
line = 1mark



(ii) 6 minutes; 3.1g; error in reading mass shown on balance; [2]

(d) (i) 14 minutes;

(ii) 3.2g;

(e) Loss of carbon dioxide produced by the reaction; [1]

(f) On graph paper
Steep slope/sketch graph on left of plotted graph;
Same volume of gas produced; [2]

45 21 [Total 14]

2 (a) 16.7g; [1]

(b) 16.7g – 1.5g/15.2g; [1]

(c) $\frac{15.2g}{40.0g}$; . 0.38 moles; [2]

(d) Answer to (c) x $\frac{1000cm^3}{250cm^3}$; [2]

[Total 6]

3 (a) (i) 27.5g – 25.1g/2.4g Mg; [1]

(ii) 29.1g – 25.1g/4.0g (MgO); [1]

(iii) 4.0g – 2.4g/1.6g O; [1]

(iv) Mg : O

$$\frac{2.4g}{24.0g} : \frac{1.6g}{16.0g} \Big/ \frac{Answer\ to(1)}{24.0} : \frac{Answer\ to(iii)}{16.0};$$

1 : 1 / MgO; [2]

(b) To enable more oxygen (air) to get into crucible to complete oxidize magnesium; [1]

(c) A constant mass reading shown on the balance; [1]

[Total 7]

4 (a) B, C, A; [2]

(b) (i) Hydrogen; [1]

(ii) **test**
insert a burning splint in jar; [1]

observation
pop sound; [1]

[Total 5]

46

5 (a) pipette;

(b)

Experiment	1	2	3
Final burette reading/cm^3	14.0	28.0	49.4
initial burette reading/cm^3	0.0	14.0	36.2
Volume of E_2SO_4 used/cm^3	14.0	14.6	14.2
Best titration results	✓	✓	

Average volume of $E_2SO_4 = \frac{(12.6+12.5)cm^3}{2}$

$= 14.0\ cm^3$

Summary

25.0 cm^3 of sodium hydroxide required 14.0 cm^3 of E_2SO_4; [8]

(c) $2NaOH(aq) + E_2SO_4 \longrightarrow Na_2SO_4\ (aq) + 2H_2O\ (l)$ [2]

(d) $\frac{25.0\,cm^3}{1000cm^3} \times 0.1/0.0025$ *moles*; [1]

(e) (i) $\frac{\text{Answer to (d)}}{2}$; [1]

(ii) $\frac{0.1\ moldm^{-3} \times 25.0cm^3}{2 \times \text{titre (average)}}$;

Answer to (i) $\times \frac{1000}{\text{average titre}}$; [1]

(iii) Answer to (ii) × 98.0; [1]

(Total = 15 Marks)

47

6 (a) reduce heat loss by conduction; [1]

(b)

Exp.	Volume of Hydrochloric acid/cm^3	Volume of Sodium hydroxide/cm^3	Initial temperature /°C	Final temperature /°C	Change in temperature /°C
1			22.0	22.0	0.0
2			22.0	25.0	3.0
3			22.0	28.0	6.0
4			22.0	30.0 30.1	8.0
5			22.0	29.5	7.5
6			22.0	29.0	7.0

(c) (i) $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$ [2]

correct formula;
balanced equation;

(ii) Neutralization;

(d) $\frac{45.0cm^3}{1000cm^3} \times 1.0mol/0.045mol$; [1]

(e) 0.045mol/answer to (d); [1]

(f) (i) Experiment 4;

(ii) q = (45 + 30) cm^3 × 4.3J/cm^3°C x 8.0°C
= 2 580 J; [2]

(g) All (H^+) hydrogen ions in solution had been used up in reaction/
Further addition of sodium hydroxide solution cools the reaction mixture; [1]

(h) Loss of heat through evaporation since mouth of plastic cup is open; [1]

Total = 16 marks

48

Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY

PAPER 3 Practical Test

5071/3

NOVEMBER 2011

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculators

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 5 printed pages and 3 blank pages.

[Turn over

For Examiner's Use

1 You are required to determine the concentration of W.

E is 1.0mol dm^{-3} sodium hydroxide, $NaOH_{(aq)}$.

W is aqueous sulphuric acid, $H_2SO_{4(aq)}$.

Pipette 25.0 cm^3 of E into a conical flask.

Add 3 to 5 drops of methyl orange indicator to solution E.

Fill a burette with solution W.

Run solution W into the conical flask until a colour change is observed.

Record the results in **Table 1**.

Repeat the experiment as many times as you consider necessary to obtain accurate results.

Results

Table 1

Experiment	1	2	3		
Final Burette reading/cm^3					
Initial Burette reading/cm^3					
Volume of W used/cm^3					
Best titration results					

[15]

Tick (✓) the best titration results.

Summary

Using these results, calculate the average volume of W required to react with 25.0 cm^3 of E.

25.0 cm^3 of E required _____ cm^3 of W

SC

For Examiner's Use

(a) Write the equation for the reaction between sodium hydroxide and sulphuric acid. [1]

(b) Calculate the number of moles of sodium hydroxide in 25.0 cm^3 solution E. [1]

(c) Calculate the number of moles of sulphuric acid in the volume of solution W required to neutralise 25.0 cm^3 of E. [1]

(d) Calculate the concentration of sulphuric acid in:

(i) $moldm^{-3}$. [1]

(ii) gdm^{-3}

[M_r: sulphuric acid = 98] [1]

[Total = 20]

For Examiner's Use

2 You are required to determine the heat energy released when dilute hydrochloric acid is reacted with aqueous sodium hydroxide.

X is 1.0 moldm^{-3} hydrochloric acid.

Y is 1.5 moldm^{-3} sodium hydroxide.

Using a measuring cylinder, place 45.0 cm^3 of **X** into a plastic cup.

Measure the initial temperature of **X** and record it in **Table 2**.

Measure 10.0 cm^3 of **Y** using another measuring cylinder. Pour **Y** into the plastic cup containing **X**.

Stir the mixture and record the highest temperature reached.

Thoroughly rinse the plastic cup with distilled water.

Using the same volume of **X**, repeat the experiment using 20.0 cm^3; 30 cm^3; 40.0 cm^3 and 50.0 cm^3 of **Y**.

Record your results in **Table 2**.

Table 2

Experiment	Volume of hydrochloric acid used /cm^3	Volume of sodium hydroxide used/cm^3	Initial temperature of X/°C	Final temperature /°C	Change in temp. /°C
1	45.0	10.0			
2	45.0	20.0			
3	45.0	30.0			
4	45.0	40.0			
5	45.0	50.0			

[15]

S2

For Examiner's Use

(a) Write a balanced equation for the reaction between dilute hydrochloric acid and sodium hydroxide. [1]

(b) Calculate the number of

(i) moles of dilute hydrochloric acid that were placed in the plastic cup, [1]

(ii) moles of sodium hydroxide that were placed in the plastic cup for the experiment that gave the highest change in temperature. [1]

(c) Use your answers to **(b)** to determine the limiting reactant. [1]

(d) Using the experiment that gives the highest temperature change, calculate the amount of heat energy released by the reaction.

[*Heat energy in Joules = total volume of solution × 4.3 × change in temperature*].

[1]
[Total: 20]

23

26

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2011

CHEMISTRY 5071/3

5-5

27

1 burette readings to 1 decimal place and in correct spaces; [1]

correct subtraction; [1]

best titration results and summary like; [1]

Award accuracy marks as follows:

Mark	Difference from supervisor
12	0.0 to 0.1
11	0.1 to 0.2
10	0.2 to 0.3
9	0.3 to 0.4
8	0.4 to 0.5
7	0.5 to 0.6
6	0.6to 0.7
5	0.7 to 0.8
4	0.8 to 0.9
3	0.9 to 1.0
2	1.0 to 1.1
1	1.1 to 1.2
0	Greater than 1.2

(a) $2NaOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$ [1]

(b) $\frac{25.0\ cm^3}{1000\ cm^3} \times 1.0$ mol/0.025mol; [1]

(c) $\frac{0.025\ mol}{2}$;/answer to (b) ÷ 2 [1]

(d) (i) $\frac{1.0 mol dm^{-3} \times 25.0 cm^3}{fibre}$; [1]

(ii) answer to (d)(i) × 98.0 g; [1]

[Total: 20]

SL

2

Experiment	Volume of hydrochloric acid used /cm^3	Volume of sodium hydroxide used/cm^3	Initial temperature of X/°C	Final temperature /°C	Change in /°C
1	45.0	10.0			
2	45.0	20.0			
3	45.0	30.0			
4	45.0	40.0			
5	45.0	50.0			

1 mark for each entry; [15]

(a) $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} = H_2O(l)$; [1]

(b) (i) $\frac{45.0\ cm^3}{1\ 000\ cm^3} \times 1.0$ mol/0.045 mol; [1]

(ii) $\frac{30.0\ cm^3}{1\ 000\ cm^3} \times 1.5$ mol/0.045 mol; [1]

(c) Difference between answer to (b) and (c); [1]

(d) 2 580 J/Answer in relation to candidate's values of highest change in temperature and total volume of solution; [1]

[Total: 20]

57 28

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/4

PAPER 4 Alternative to Practical

NOVEMBER 2011 SESSION 1 hour

Candidates answer on the question paper.
Additional materials:
Mathematical tables and/or Electronic calculators
Ruler

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
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.
You should use names, **not** symbols, when describing all reacting chemicals and the products formed.

FOR EXAMINER'S USE	
1	
2	
3	
4	
TOTAL	

This question paper consists of 9 printed pages and 3 blank pages.

54 29

For Examiner's Use

1 An experiment was carried out to determine the relative molecular mass of an aqueous solution of 10.5 g/dm^3 of X.

X reacts with sulphuric acid according to the equation

$$X_{(aq)} + H_2SO_{4(aq)} \rightarrow XSO_{4(aq)} + CO_{2(g)} + H_2O_{(l)}$$

25 cm^3 of X was titrated with 1 mol/dm^3 sulphuric acid. Three titrations were carried out and the results are shown in **Fig. 1**.

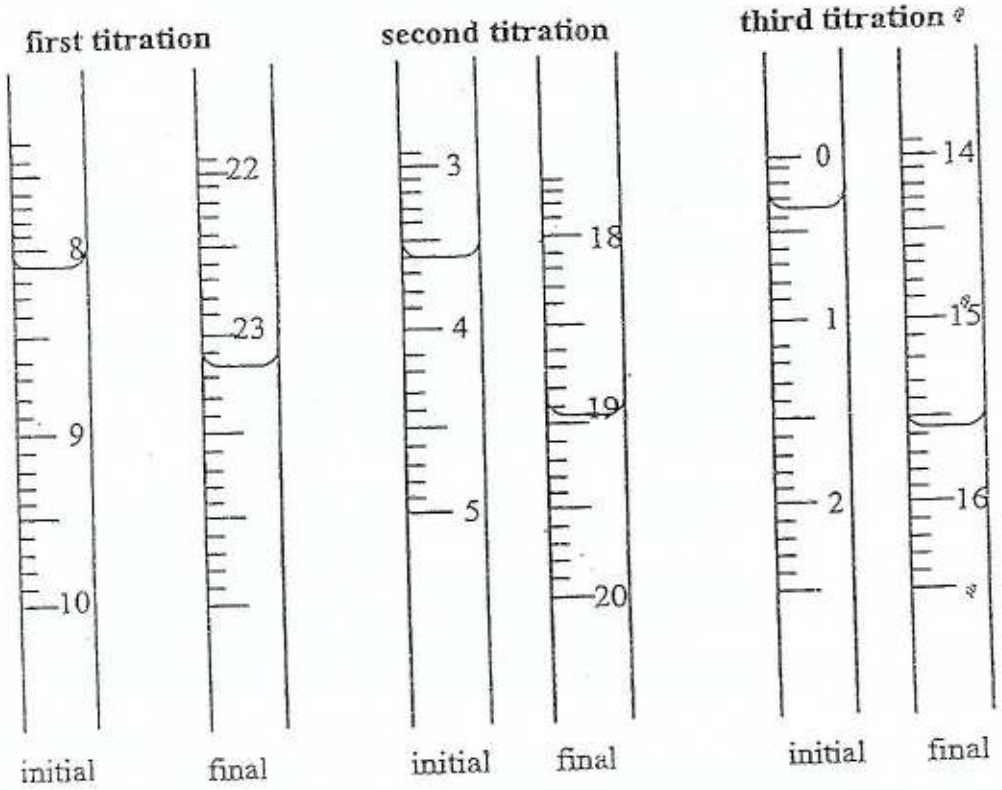


Fig. 1

6C

For Examiner's Use

(a) Read and record the volumes in Table 1.

Table 1

Titration number	First	Second	Third
Final burette reading/cm^3			
Initial burette reading/cm^3			
Volume of acid used/cm^3			
Tick the best titration results.			

Summary

25 cm^3 of X required _____ cm^3 of acid. [8]

(b) Calculate the number of moles of acid that reacted with 25 cm^3 of X.

[1]

(c) Calculate the number of moles of X in 25 cm^3 of solution X.

[1]

(d) Calculate the concentration of solution X in mol/dm^3.

[1]

6 1

30

For Examiner's Use

(e) Use your answer in (d) and the mass concentration of X to calculate the M_r of X.

[2]

[Total: 13]

2 An experiment to separate a mixture of sand, sodium chloride and ammonium chloride was set up as shown in Fig. 2.

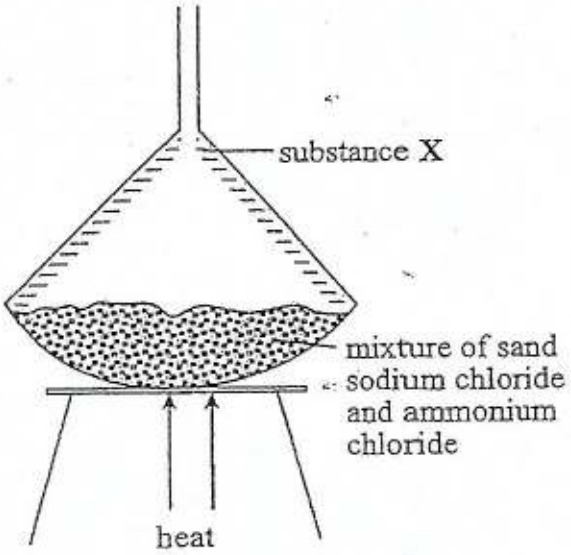


Fig. 2

(a) (i) Identify substance X.

_____ [1]

(ii) Name the process that produces X from the mixture?

_____ [1]

(2)

For Examiner's Use

(b) Draw a diagram to show a set up of the apparatus used to separate the remaining substances after heating.

[5]

(c) (i) Name the substance removed by the method shown in (b).

_____ [1]

(ii) Give a reason for your answer.

_____

_____ [1]

31

For Examiner's Use

(d) Name two substances which can be used to prepare sodium chloride by a titration method.

1. _____

2. _____ [2]

[Total: 11]

3 A mixture of powdered calcium hydroxide and ammonium chloride was heated as shown in **Fig 3**. A gas **X** was produced.

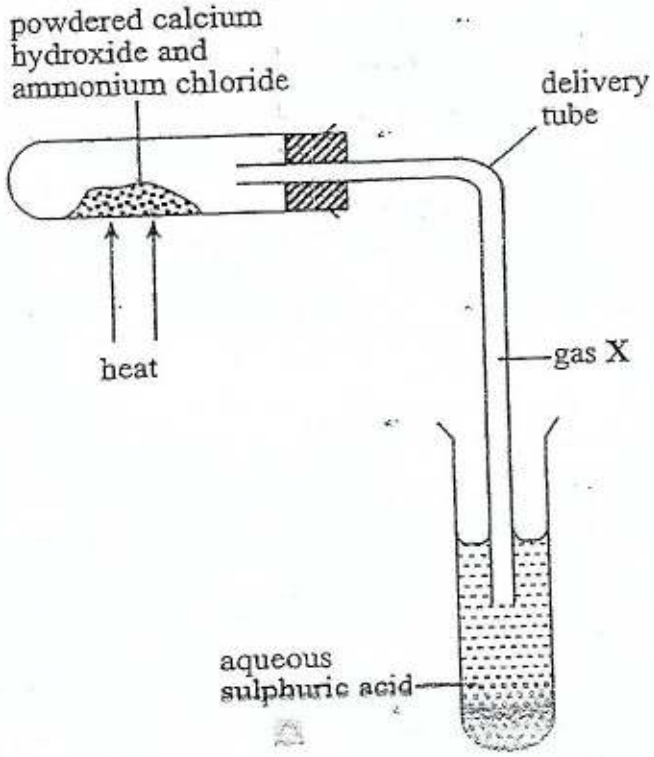


Fig. 3

(a) (i) Name gas X.

_____ [1]

E14

For Examiner's Use

(ii) Describe how you would test for gas X.

Test _____

_____

Observation _____

_____ [2]

(b) Name the substance that remained in the heated tube after the reaction.

_____

_____ [1]

(c) (i) Write an equation for the reaction of gas X with aqueous sulphuric acid.

_____

_____

_____ [2]

(ii) How would you obtain crystals of the substance formed in (c)(i)?

_____

_____

_____ [2]

[Total: 8]

65 32

For Examiner's Use

4 Chemical tests described in **Table 2** were carried cut on solid E.

(a) Complete **Table 2**.

Table 2

Test		Observation	Conclusion	
1.	E was dissolved in water and stirred.	colourless solution		
2.	The solution of E from test 1 was divided into three parts.			
(a)	To the first part _____ _____ _____ _____		Cl^-	[4]
(b)	To the second part sodium hydroxide was added until in excess.	white precipitate soluble in excess		[2]
(c)	To the third part _____ _____ _____ _____ _____		Al^{3+}	[4]

For Examiner's Use

(b) **Conclusion**

The cation present in **E** is

_____,

and anion present in **E** is

_____,

hence the molecular formula of **E** is _____. [3]

[Total: 13]

67 33

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2011

CHEMISTRY 5071/4

65 34

1 (a)

	Final	Initial	Volume used
First titration	23.15	8.10	15.05
Second titration	18.95	3.60	15.35
Third titration	15.55	0.35	15.20

[6]

Correct titration results ticked/15.35 and 15.25 [1]

Summary; correct volume of acid/ $\frac{15.35+15.20}{2}$ /15.30 [1]

(b) $\frac{25}{1000} \times 1.0/0.025$; [1]

(c) ans in (b); [1]

(d) $\frac{\text{ans(c)}}{\left(\frac{25}{1000}\right)}$; [1]

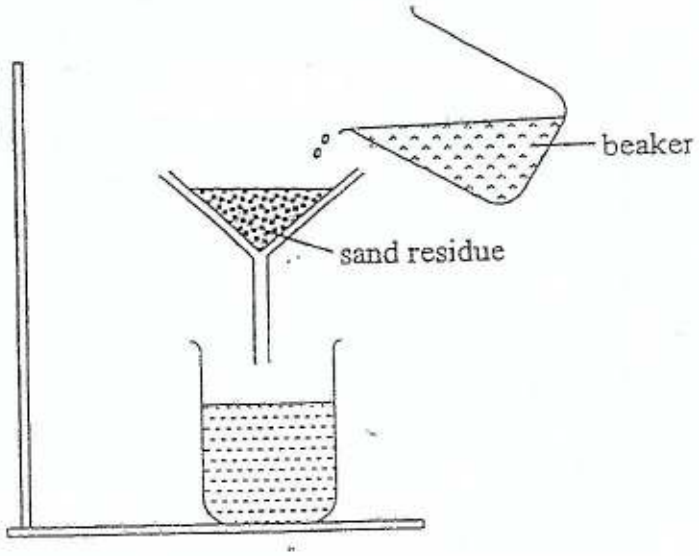
(e) $\frac{10.5}{\text{ans(d)}}$; [2]

[Total: 13]

2 (a) (i) X ammonium chloride; [1]

(ii) sublimation; [1]

(b)



7c

(c) (i) sodium chloride; [1]

(ii) sodium chloride is soluble in water, sand is not; [1]

(d) sodium hydroxide and hydrochloric acid; [2]

[Total: 8]

3 (a) (i) ammonia; [1]

(ii) test - damp red litmus paper inserted in gas;

observation - red litmus turns blue; [2]

(b) calcium chloride; [1]

(c) (i) $2NH_{3(g)} + H_2SO_{4(aq)} \rightarrow (NH_4)_2SO_{4(aq)}$ [2]

correct formulae;
balanced equation;

(ii) slow; evaporation; of solution; [2]

[Total: 8]

4 (a)

Test No	Test	Observation	Conclusion
1			No transition metal (1)
2(a)	Add acidified; (1) Silver nitrate; (1)	White; precipitate; (1) (1)	—
(b)			Al^{3+}; Zn^{2+};
(c)	Add aqueous ammonia; (1) Until in excess; (1)	White; precipitate; (2) Insoluble in excess; (1)	

(b) Cation - Al^{3+} (1) Anion - Cl^- (1)

Formulae of E - $AlCl_3$;

[Total: 13]

7/

35

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/3

PAPER 3 Practical Test

NOVEMBER 2012 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculators

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results 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.
Qualitative analysis notes for this paper are printed on page 6.

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 6 printed pages and 2 blank pages.

[Turn over

G1 45

For Examiner's Use

1 You are required to determine the relative molecular mass, M, of B.

A is 0.15 $moldm^{-3}$ nitric acid.

B is 4.8 gdm^{-3} of an aqueous hydroxide solution, XOH.

Pipette 25.0 cm^3 of B into a conical flask. Add 3 to 5 drops of phenolphthalein indicator and titrate with A.

Phenolphthalein indicator changes colour from pink to colourless at the end point.

Repeat the titration as many times as you consider necessary to obtain accurate results.

Record your results in **Table 1.**

Table 1

titration number	1	2	3	
final burette reading /cm^3				
initial burette reading /cm^3				
volume of A used /cm^3				

[15]

Tick the test titration results.

Summary

25.0 cm^3 of B required ..... cm^3 of A.

(a) Calculate the number of moles of acid in the average volume of A

[1]

72

(b) Write a balanced equation for the reaction in terms of X.

For Examiner's Use

[1]

(c) Calculate

(i) the number of moles of XOH in 25.0 cm^3 of **B**.

(ii) the number of moles of XOH in 1 dm^{-3} of **B**.

(iii) Use the expression,

$$\text{number of moles} = \frac{\text{mass}}{\text{relative molecular mass}}$$

to calculate the M_r of XOH.

[3]
[Total:20]

46

43

For Examiner's Use

2 You are provided with solid **D**.

Carry out the following tests on Solid **D**, test and identify any gases evolved.

test	observations [13]	deductions [5]
1. Dissolve D in water in a small beaker. Divide the solution into four parts.		
2 To the first part add aqueous ammonia until in excess		
3 To the second part add aqueous sodium hydroxide		
4 To the third part add aqueous hydrogen peroxide followed by aqueous sodium hydroxide until in excess		
5 To the fourth part add dilute nitric acid followed by barium nitrate		

Conclusion:

The cation present in **D** is _____ [1]

The anion present is _____ [1]

54

QUALITATIVE ANALYSIS NOTES (5071/3)

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid then add aqueous barium nitrate.	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess a colourless solution	white ppt., insoluble in excess giving
ammonium (NH_4^+)	ammonia produced on warming	
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron (II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron (III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Tests for gases

gas	*test and result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint
sulphur dioxide (SO_2)	turns aqueous potassium dichromate (VI) from orange to green

47

45

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2012

CHEMISTRY 5071/3

47 48

1 (a) Burette readings to 1 d.p. in correct spaces [1]

Correct subtraction; [1]

Best titration results and summary litre [1]

Award accuracy marks as follows:

Accuracy

	Accuracy Marks
Mark	Difference from Supervisor
12	0.0 + to 0.1
11	0.1$^+$ to 0,2
10	0.2$^+$ to 0.3
9	0.3$^+$ to 0.4
8	0.4$^+$ to 0.5
7	0.5$^+$ to 0.6
6	0.6$^+$ to 0.7
5	0.7$^+$ to 0.8
4	0.8$^+$ to 0.9
3	0.9$^+$ to 1.0
2	1.0$^-$ to 1.1
1	1.1$^+$ to 1.2
0	Greater than 1.2

(a) titre x 0.15; [1]

(b) $XOH + HNO_3 \rightarrow XNO_3 + H_2O$; [1]

(c) (i) Answer to (a) ; [1]

(ii) Answer to (c) (i) $X \frac{1000}{25}$ / ans (c) X 40; [1]

(iii) $\frac{4.8\ g}{\text{ans (c) (ii)}}$; [1]

2 **Table of results**

Test	Observations [12]	Deductions [5]
1. Dissolve D in water in a small beaker. Divide the solution into four parts.	green soln; [1]	transition metal; [1]
2 To the first part add aqueous ammonia until in excess	green ppt [1] insolb. [1]	Fe^{2+} [1]
3 To the second part add aqueous sodium hydroxide	green ppt [1] insolb. [1]	Fe^{2+} [1]
4 To the third part add aqueous hydrogen peroxide followed by aqueous sodium until in excess	Brown soln. [1] red brown; ppt. [2] insolb. [1]	Fe^{2+} [1]
5 To the fourth part add dilute nitric acid followed by barium nitrate	white ppt. [1] [1]	SO_4^{2-} [1]

Conclusion

The cation present in D is Fe^{2+} [1]

The anion present in D is SO_4^{2-} [1]

[Total 20]

45 4 c

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

5071/2

CHEMISTRY

PAPER 2 Theory

NOVEMBER 2012 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 separate answer paper provided .
At the end of the examination, fasten any separate answer paper used securely to the question paper.
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 on page 12.

FOR EXAMINER'S USE	
Section A	
Section B	

This paper consists of 12 printed pages.

[Turn over

73 36

Section A

Answer all the questions in the spaces provided.

The total mark for this section is 45.

For Examiner's Use

1 A gas jar at room temperature and pressure, contains a mixture of equal volumes of ammonia ($M_r = 17$) and ethane ($M_r = 30$)

(a) State which molecules in the gas jar are moving faster.

_____

Give reasons for your answer.

_____

_____ [2]

(b) The gas jar is placed in a refrigerator. State and explain what happens to the speed of these molecules.

_____

_____ [2]

(c) State the changes that will take place in the physical states of the substances if the temperature of the mixture is continuously reduced.

_____

_____ [2]

[Total:6]

74

For Examiner's Use

2 Fig.1 represents an ion of an element Y.

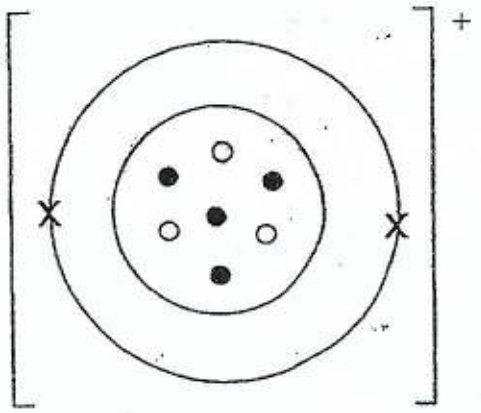


Fig.1

(a) Write down the chemical symbol of Y.

_____ [1]

(b) Which symbol in **Fig.1** represents protons?

_____ [1]

(c) What name is given to a positively charged ion?

_____

_____ [1]

(d) Write the formula of the ionic compound formed between the ion of element Y and a chloride ion.

_____

_____ [1]

[Total :4]

25

37

For Examiner's Use

3 (a) Sodium hydroxide reacts with hydrochloric acid according to the equation

$$HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}.$$

(i) Calculate the mass of sodium chloride that is formed when 0.2 moles of hydrochloric acid reacts with 0.1 moles of sodium hydroxide.

mass = _____ [2]

(ii) State **one** domestic use of sodium chloride.

_____

_____ [1]

(b) (i) Define oxidation in terms of oxidation number.

_____

_____ [1]

(ii) Calculate the oxidation number of nitrogen in ammonia.

oxidation number _____ [2]

2-6

(iii) Draw a dot and cross diagram of a molecule of ammonia.

For Examiner's Use

[Total: 8]

4 Ethene is a member of the alkene group of hydrocarbons.

(a) (i) Define a *hydrocarbon*.

_____ [1]

(ii) Draw the full structural formula of the compound formed when ethene reacts with bromine gas.

[1]

(b) The following are compounds of nitrogen and other elements:
ammonia, calcium nitrate, amino acid, cobalt (II) nitrate, ammonium nitrate

Give from the list a compound

1. that contains only **two** elements,

_____

_____ [1]

77 3.8

For Examiner's Use

2. used as a monomer in the production of proteins,

_____

_____ [1]

3. that contains a transition element.

_____ [1]

[Total:5]

5 Sodium phosphate, Na_3PO_4, is a soluble salt used as a water softener in washing powders. It is made by reacting dilute phosphoric acid, $H_3PO_{4(aq)}$ and an alkali.

(a) Give the formula of the **two** ions found in the salt.

1. _____ [1]

2. _____ [1]

(b) (i) Name the alkali which reacts with phosphoric acid to give sodium phosphate.

_____ [1]

(ii) Give the formula of the gas formed during this reaction.

_____

_____ [1]

(iii) Describe the test for this gas.

_____

_____

_____ [2]

(c) Ammonium phosphate is used as a fertilizer. Write the formula of ammonium phosphate .

_____

_____ [1]

[Total : 7]

7 8

For Examiner's Use

(a) Write a balanced equation for the reaction between hydrogen and oxygen.

_____ [1]

(b) The reaction in (a) is an example of a redox reaction.

(i) State the oxidising agent,

_____

(ii) Define the term *redox*.

_____

_____ [2]

(c) The enthalpy change of reaction between hydrogen and oxygen is negative.

Explain.

_____

_____ [1]

(d) Calculate the volume occupied by 56 kg of oxygen gas at room temperature and pressure.

volume _____ [3]

[Total : 7]

7 During the manufacture of ammonia, raw materials are required and certain conditions are employed to obtain the product.

(a) Name the process by which ammonia is produced.

_____ [1]

For Examiner's Use

(b) Name the **two** raw materials used in the manufacture of ammonia.

1. _____

2. _____ [2]

(c) State **three** conditions which are used in the manufacture of ammonia.

1. _____

2. _____

3. _____ [3]

(d) Write the equation for this reaction.

_____

_____

_____ [2]

[Total: 8]

Section: B

Answer any three questions from this section.

8 In the contact process, sulphur dioxide and oxygen are converted to sulphur trioxide.

(a) (i) State the conditions used in the conversion to sulphur trioxide and write the equation for the reaction that takes place.

(ii) Describe the effect of increasing

1. temperature and

2. the pressure at which the conversion is carried out. [6]

(b) (i) Describe how sulphur dioxide is converted to sulphuric acid.

(ii) State **one** use of sulphuric acid. [4]

[Total:10]

9 (a) Fig.2 shows structure of a polymer.

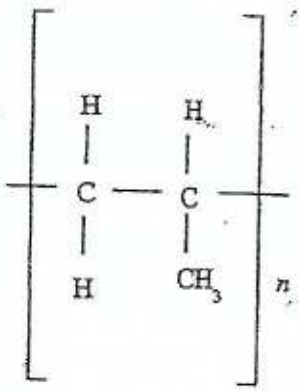


Fig.2

(i) Define the term *polymer*.

(ii) Name the monomer from which this polymer was made.

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

5071/2

CHEMISTRY

PAPER 2 Theory

NOVEMBER 2012 SESSION 1 hour 30 minutes

Additional materials:
Answer paper
Mathematical tables and/or Electronic calculator

TIME 1 hour 30 minutes

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Section B	

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[Turn over

73 36

Section A

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For Examiner's Use

1 A gas jar at room temperature and pressure, contains a mixture of equal volumes of ammonia ($M_r = 17$) and ethane ($M_r = 30$)

(a) State which molecules in the gas jar are moving faster.

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Give reasons for your answer.

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_____ [2]

(c) State the changes that will take place in the physical states of the substances if the temperature of the mixture is continuously reduced.

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_____ [2]

[Total:6]

74

For Examiner's Use

2 Fig.1 represents an ion of an element Y.

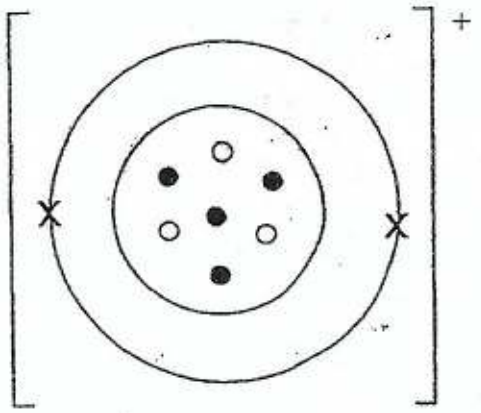

Fig.1

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(c) What name is given to a positively charged ion?

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_____ [1]

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_____ [1]

[Total :4]

25

37

For Examiner's Use

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$$HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}.$$

(i) Calculate the mass of sodium chloride that is formed when 0.2 moles of hydrochloric acid reacts with 0.1 moles of sodium hydroxide.

mass = _____ [2]

(ii) State **one** domestic use of sodium chloride.

_____

_____ [1]

(b) (i) Define oxidation in terms of oxidation number.

_____

_____ [1]

(ii) Calculate the oxidation number of nitrogen in ammonia.

oxidation number _____ [2]

2-6

(iii) Draw a dot and cross diagram of a molecule of ammonia.

For Examiner's Use

[Total: 8]

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(a) (i) Define a *hydrocarbon*.

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(ii) Draw the full structural formula of the compound formed when ethene reacts with bromine gas.

[1]

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Give from the list a compound

1. that contains only **two** elements,

_____

_____ [1]

77 3.8

For Examiner's Use

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_____ [1]

3. that contains a transition element.

_____ [1]

[Total:5]

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(a) Give the formula of the **two** ions found in the salt.

1. _____ [1]

2. _____ [1]

(b) (i) Name the alkali which reacts with phosphoric acid to give sodium phosphate.

_____ [1]

(ii) Give the formula of the gas formed during this reaction.

_____

_____ [1]

(iii) Describe the test for this gas.

_____

_____

_____ [2]

(c) Ammonium phosphate is used as a fertilizer. Write the formula of ammonium phosphate .

_____

_____ [1]

[Total : 7]

7 8

For Examiner's Use

(a) Write a balanced equation for the reaction between hydrogen and oxygen.

_____ [1]

(b) The reaction in (a) is an example of a redox reaction.

(i) State the oxidising agent,

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(ii) Define the term *redox*.

_____

_____ [2]

(c) The enthalpy change of reaction between hydrogen and oxygen is negative.

Explain.

_____

_____ [1]

(d) Calculate the volume occupied by 56 kg of oxygen gas at room temperature and pressure.

volume _____ [3]

[Total : 7]

7 During the manufacture of ammonia, raw materials are required and certain conditions are employed to obtain the product.

(a) Name the process by which ammonia is produced.

_____ [1]

For Examiner's Use

(b) Name the **two** raw materials used in the manufacture of ammonia.

1. _____

2. _____ [2]

(c) State **three** conditions which are used in the manufacture of ammonia.

1. _____

2. _____

3. _____ [3]

(d) Write the equation for this reaction.

_____

_____

_____ [2]

[Total: 8]

Section: B

Answer any three questions from this section.

8 In the contact process, sulphur dioxide and oxygen are converted to sulphur trioxide.

(a) (i) State the conditions used in the conversion to sulphur trioxide and write the equation for the reaction that takes place.

(ii) Describe the effect of increasing

1. temperature and

2. the pressure at which the conversion is carried out. [6]

(b) (i) Describe how sulphur dioxide is converted to sulphuric acid.

(ii) State **one** use of sulphuric acid. [4]

[Total:10]

9 (a) Fig.2 shows structure of a polymer.

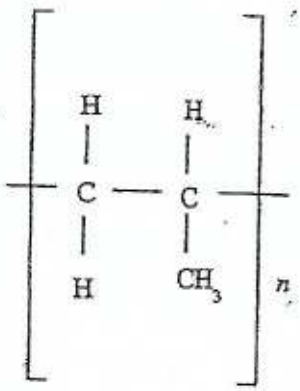


Fig.2

(i) Define the term *polymer*.

(ii) Name the monomer from which this polymer was made.

(iii) Draw the displayed structural formula of the monomer you named in **(ii)**.

(iv) Calculate the percentage by mass of carbon in this monomer. [5]

(b) Fig.3(a) and 3(b) show monomers which are used to make nylon.

Fig. 3 (a)

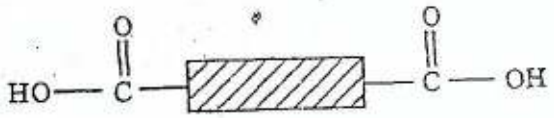


Fig. 3 (b)

(i) Draw the repeat unit of nylon.

(ii) Label, by name, on your diagram, the linkage found in nylon.

(iii) Name this type of polymerisation. [3]

(c) Describe how the chemical composition of carbohydrates differs from that of a protein. [2]

[Total:10]

10 Aluminium oxide is electrolysed in its molten form to give aluminium metal using the cell shown in **Fig. 4.**

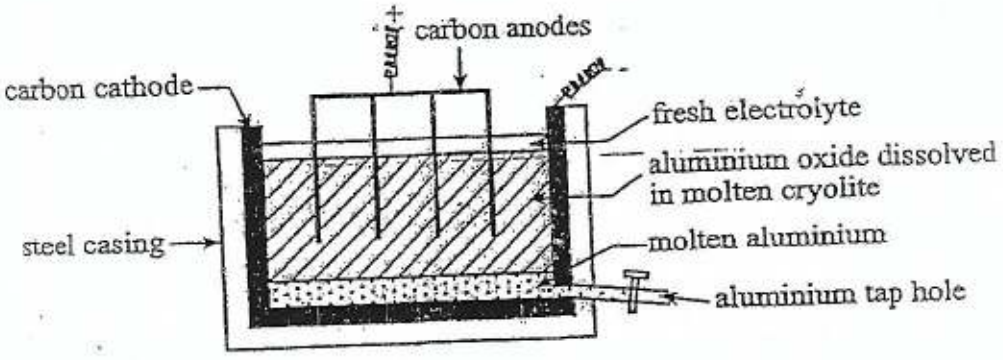


Fig. 4.

(a) (i) Write the equation for the reactions which occur at the electrodes.

62

(ii) State the function of the molten cryolite.

(iii) Explain why the carbon electrodes should be replaced frequently. [5]

(b) (i) Explain why aluminium **cannot** be obtained by the reduction of aluminium oxide using carbon.

(ii) Give **one** use of aluminium and the property that makes it suitable for this use.

[5]
[Total:10]

11 (a) (i) Write an equation for the thermal decomposition of calcium carbonate, $CaCO_3$.

(ii) Explain why the reaction in (i) is an important industrial process.

(iii) Calculate the mass of calcium oxide obtained from the decomposition of 10 g of $CaCO_3$. [7]

(b) Silicon is a common element in most rocks. It combines with oxygen to form silicon (IV) oxide.

(i) State any **one** use of 1. silicon (IV) oxide,

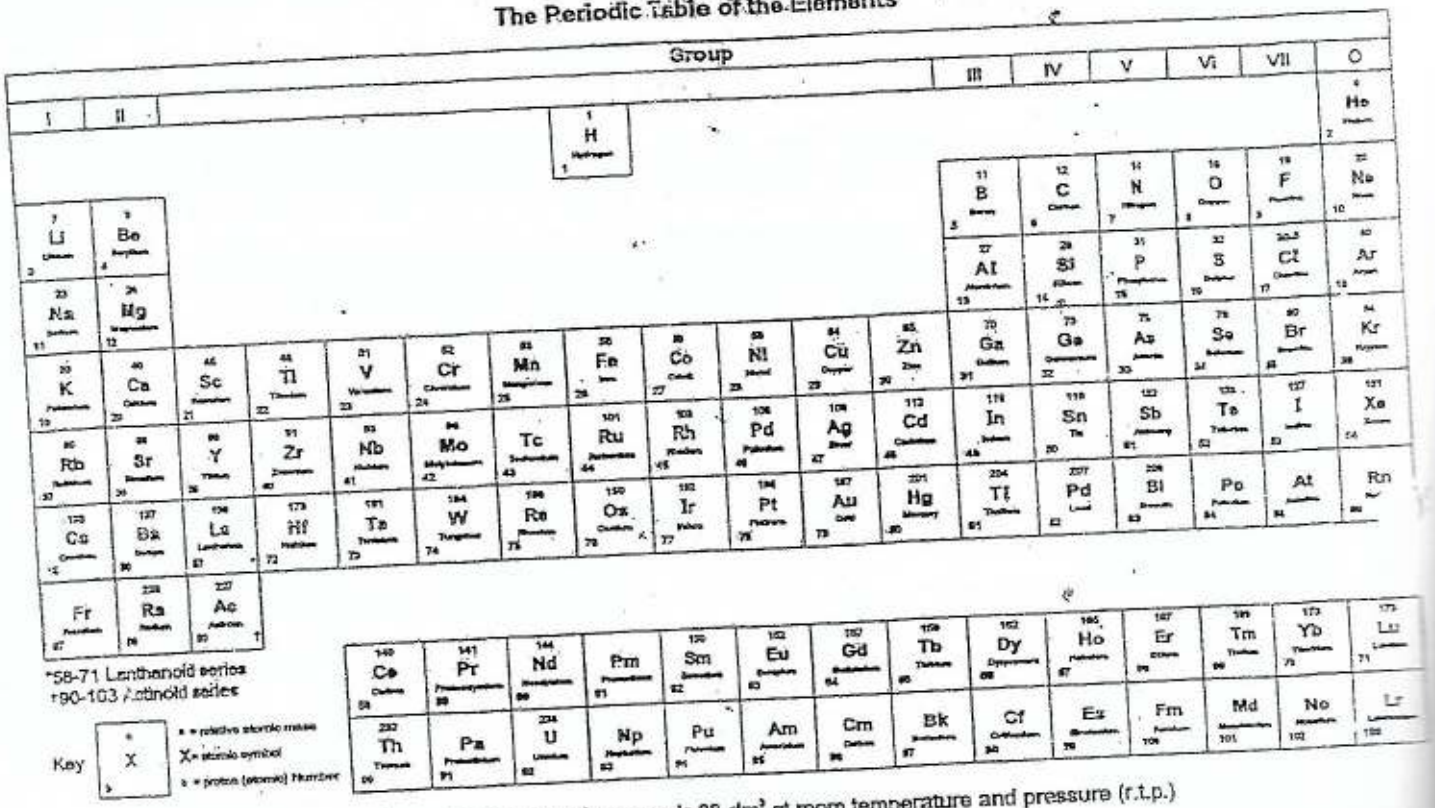
2. the element silicon.

(ii) State a reason for the use of the silicon.

[3]
[Total :10]

53 41

DATA SHEET
The Periodic Table of the Elements



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

Key: X (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 EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2012

CHEMISTRY

5071/2

85 42

1 (a) Ammonia; [1]

Has smaller M_r/ lighter [1]

(b) Decrease; [1]
temp less than room temperature [1]

(c) gas → liquid; → solid; [1]

2 (a) Li; [1]

(b) O; [1]

(c) cation; [1]

(d) $LiCl$ / YCl; [1]

3 (a) (i) $\left(m(NaCl) - n(NaCl) \cdot M_r(NaCl)\right)$

$mol\,(NaCl) = 0.1$ mol; [1]

$M_r(NaCl) = 58.5$ [1]

Mass $(NaCl)$ 0.1 x 58.5;/ 5.85 g; [1]

(ii) Seasoning food/ preservation of food;/AW [1]

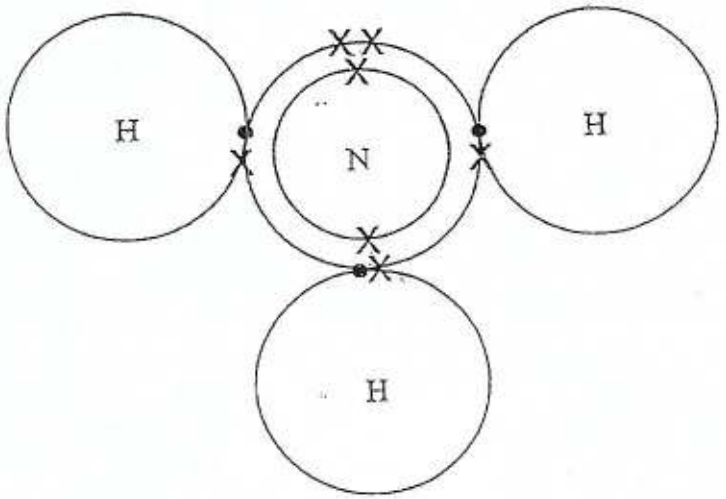
(b) (i) An increase in the oxidation number [1]

(ii) $NH_3 \rightarrow x + 3(+1) = 0$

$x = 0 - 3$ [1]

$= -3$ [1]

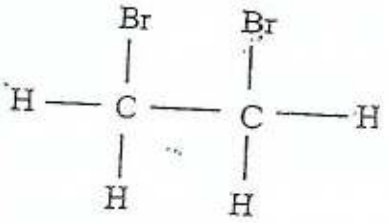
(iii)



[2]

(a) (i) A compound containing carbon and hydrogen only./AW; [1]

(ii)



[1]

(b) 1. Ammonia; [1]

2. Amino acids; [1]

3. Cobalt (II) nitrate; [1]

5 (a) PO_4^{3-}; Na^+; [2]

(b) (i) Sodium hydroxide; (A) formula [1]

(ii) H_2O vapour. (R – Name) [1]

(iii) expose gas to cobalt paper; [1]

cobalt paper turns blue; [1]

(c) $(NH_4)_3PO_4$. [1]

(a) $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$ [1]

(b) (i) O_2/oxygen [1]

(ii) A reaction in which oxidation and reduction takes place s simultaneously/AW [1]

(c) It releases heat to the environment/ AW [1]

(d) $\frac{56}{32}$; × 24 dm^3; [1]

42 dm^3; [1]

57 43

7 (a) Habor process; [1]

(b) 1. Hydrogen/ H_2; [1]

2. Nitrogen/ N_2; [1]

(c) temperature 450 °C or 400 – 500 °C; [1]

Pressure 250250° atm or 200 – 300 atm; [1]

Catalyst Fe/Fe_2O_3; (A) correct names [1]

(d) $N_{2(g)} + 3H_{(2)(g)} \rightleftharpoons 2NH_{3(g)}$ [2]

(balancing;)

reversible;)

8 (a) (i) moderate temperature/ 450°C/ 723k; [1]

high pressure;

Vanadian pentoxide (V_2O_3) catalysst;

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ + heat; [1]

(ii) 1. increasing temperature causes SO_3 to break down/ decompose to SO_2 and O_2/ less $SO_{3(g)}$ produced

2. increasing pressure increases yield/ amount of $SO_{3(g)}$/AW. [1]

(b) (i). SO_3 is absorbed in concentrated sulphuric acid; [1]

to form oleum/ $H_2O_2O_7$; which is diluted to give sulphuric acid; [1]

(ii) manufacture of paints/ detergents/ soap/fertilizers/ dyes; [1]

9 (a) (i) a macromolecule formed by the joining of monomers/ AW; [1]

(ii) propene; ® formula; [1]

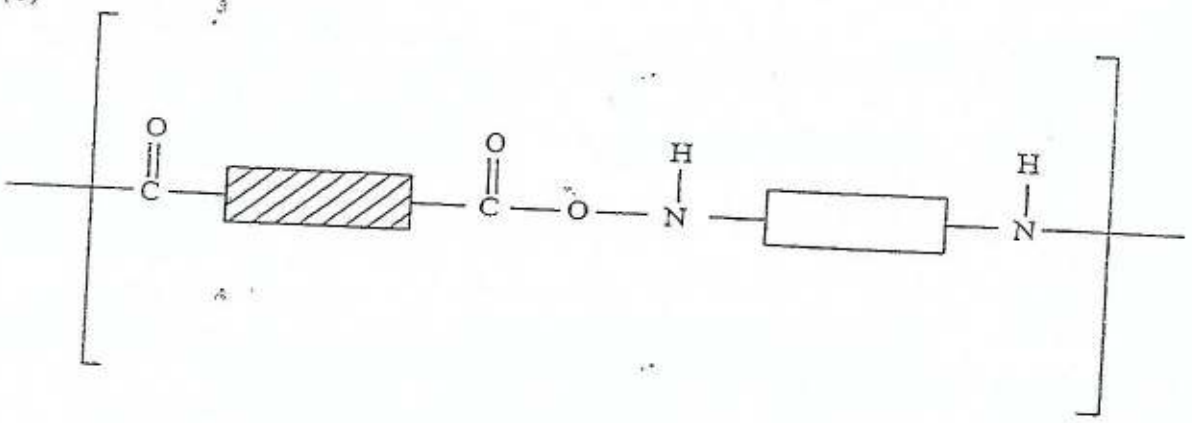
(iii) correct structural formula of propane; [1]

XX

(iv) $\frac{36}{42} \times 100$ %; [1]

correct ans; [1]

(b)



(ii) amide;[labelled on diagram] [1]

(iii) condensation of polymerization [1]

(c) carbohydrate consists of carbon hydrogen and oxygen; [1]

proteins consists of carbon hydrogen oxygen and nitrogen; [1]

10 (a) (i) cathode: $Al^{3+}_{(l)} + 3e^- \rightarrow Al_{(l)}$; [1]

anode $2O^{2-} - 4e^- \rightarrow O_{2(g)}$; [1]

(ii) Reduce/ lower mpt of electrolyte; [1]

(iii) may get used up;/ AW [1]

by reacting with O_2 produced / oxidised to CO_2/ AW; [1]

(b) (i) Aluminium is above carbon in the reactivity series/ aluminium is more reactive than carbon; [1]

Aluminium – oxygen bond is very strong/ carbon unable to reduce aluminium. [1]

(ii) any correct use – property link; [2]

5C7 4H4

11 (a) (i) $CaCO_{3(s)} \xrightarrow{heat} CaO_{(s)} + CO_{2(g)}$; [1]

(ii) produces two useful products $CaO_{(2)}$;/ lime and CO_2 carbon dioxide;
lime use for neutralising acidic soils/ industrial waste products; [1]

CO_2 used in the manufacture o dry ice in the extinguishers/ manufacture of fizzy drinks. [1]

(iii) moles of CaO

$= \frac{10\ g}{100}(M_r CaCO_3)$; [1]

mass of CaO $= (M_r CaCO_3) \times 0.1$; [1]

$= 5,6\ g$ [1]

[1]

(b) (i) manufacture of glass;/

manufacture of silicon;/

manufacture of concrete;/

[any]

(ii) in electrical components/
manufacture of silicones [1]

(iii) Silicones are consistent to high temperatures.

60

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/4

PAPER 4 Alternative to Practical

NOVEMBER 2012 1 hour

Candidates answer on the question paper.
Additional materials:
Mathematical tables and/or Electronic calculators
Ruler

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
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.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	

This question paper consists of 11 printed pages and 1 blank pages.

R01 S70

For Examiner Use

1 Fig.1 shows a simple cell.

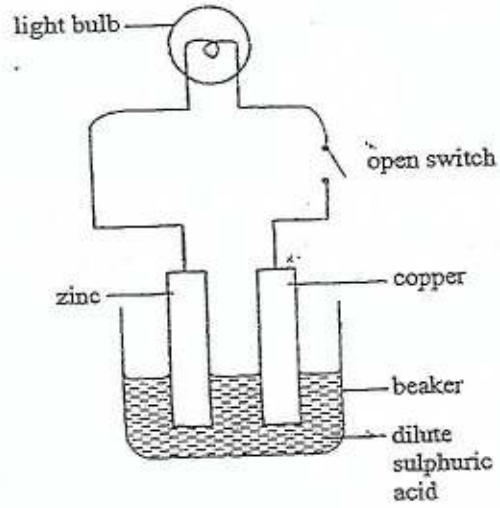


Fig.1

(a) (i) Label on the diagram the positive and negative terminals. [1]

(ii) Indicate by arrows the direction of flow of electrons. [1]

(b) State the observations made when,

(i) the switch is closed,

_____

_____ [1]

(ii) the zinc electrode is replaced with an iron electrode,

_____

_____ [1]

(iii) the zinc electrode is replaced with a magnesium electrode.

_____

_____ [1]

[Total: 5]

102

For Examiner's Use

Fig. 2 shows a set of apparatus used in an experiment by a class.

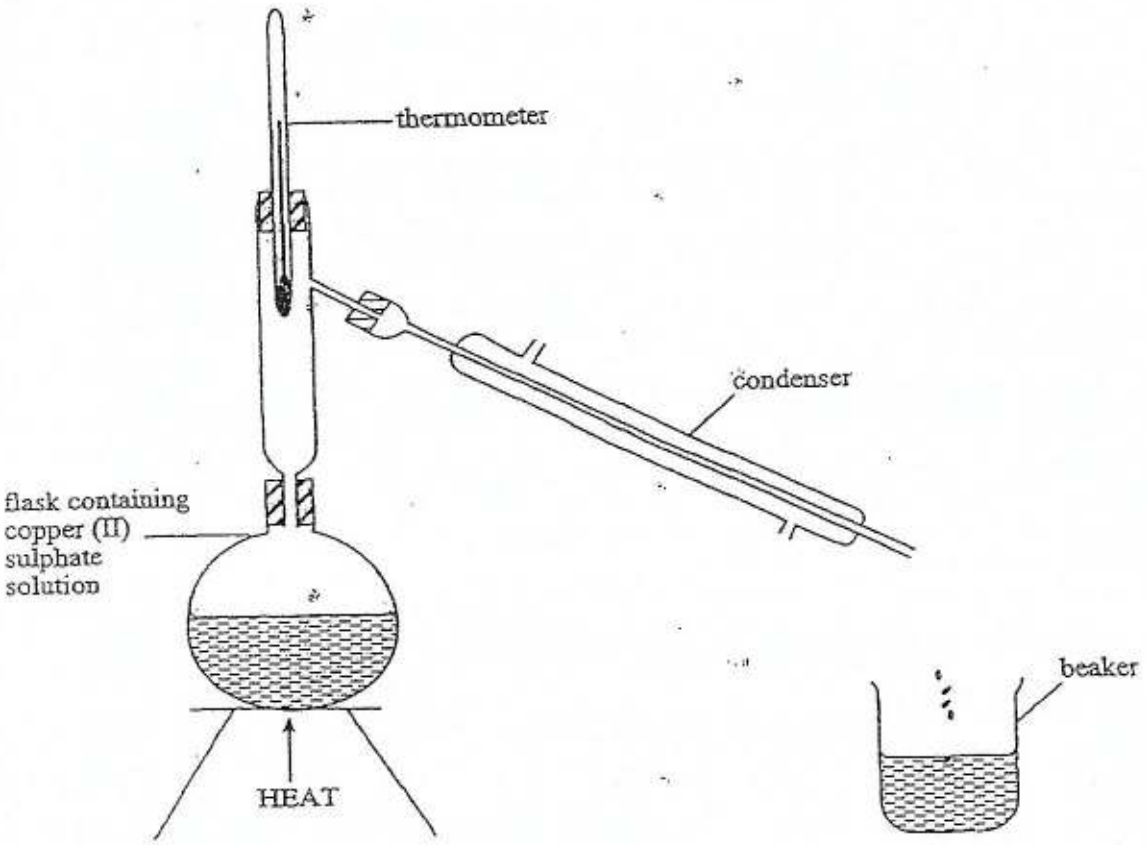


Fig.2

(a) (i) Draw arrows on **Fig.2** to show flow of water

1. in and

2. out of the condenser. [2]

(ii) Name the procedure shown in **Fig.2.**

_____ [1]

(iii) Explain why the thermometer bulb should be kept in the position shown.

_____ [1]

K03

51

For Examiner's Use

(b) The students heated the flask until the solution boiled.

State any **three** observations made when the solution was boiled for a long time.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

(c) The students repeated the experiment using a flask containing a solution of ethanol and maintained the temperature at 78 °C.

(i) Describe **one** difference observed by the students in the two experiments.

_____

_____ [1]

(ii) Explain why the students maintained the temperature at 78 °C in the second experiment.

_____

_____ [1]

(iii) Suggest **one** improvement the students should make to the second experiment for the procedure to be more efficient.

_____

_____ [1]

[Total:10]

1 C 4

For Examiner's Use

An aqueous solution **M** contains 28.6 g/dm^3 of sodium carbonate, $Na_2CO_3 \, x \, H_2O$. **N** is 0.24 mol/dm^3 hydrochloric acid.

A titration method was used to determine the value of x.

(a) (i) Name a suitable indicator for this titration.

_____ [1]

(ii) State its colour in

1. acid _____ [1]

2. alkali _____ [1]

(b) Three titrations were performed each using 25.0 cm^3 of solution **M**. Fig. 3 shows parts of the burettes with volumes of solution N before and after each titration.

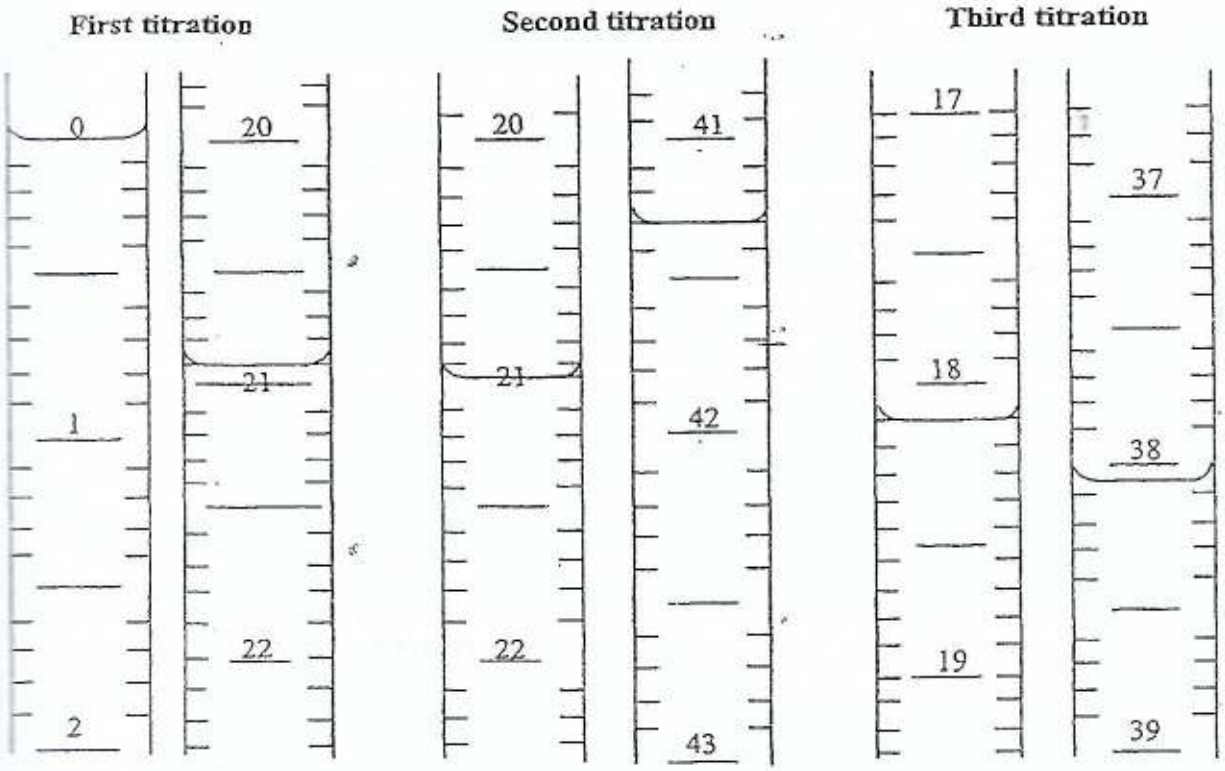


Fig. 3

165 52

For Examiner Use

Complete **Table 1.**

Table 1

Titration number	1	2	3
Final burette reading/ cm^3			
Initial burette reading/ cm^3			
Volume of N used/ cm^3			

Tick the best titration results.

25.0 cm^3 of M required _____ cm^3 of N.

(c) Given that the equation for the reaction is

$$Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$$

(i) calculate the number of moles of hydrochloric acid in the volume of N used,

$[M_r : Na_2CO_3 \, x \, H_2O = 106]$

(ii) deduce the number of moles of sodium carbonate that reacted with the acid,

106

For Examiner's Use

(iii) calculate the mass of sodium carbonate used up in 25 cm^3 of M,

(iv) deduce the mass of sodium carbonate in 1 dm^3 of M.

(d) Calculate

(i) the mass of water of crystallization in $Na_2CO_3 x H_2O$,

(ii) the number of moles of water of crystallization.
[A, : H = 1, O = 16]

[Total:16]

4 Table 2 shows tests, which were carried out on substance P.

For Examiner Use

(a) Complete **Table 2.**

Table 2.

test	observation	conclusion
1. P was dissolved in distilled water and the solution was divided into thee parts.		Cu^{2+} ions
2. To the first part of solution P aqueous sodium hydroxide was added until in excess.		
3. To the second part of P aqueous ammonia was added until in excess.		
4. To the third part of solution P aqueous sodium hydroxide was added followed by aluminium foil. The mixture was warmed carefully.		

[16]

(b) The formula of P is _____ [1]

[Total 17]

For Examiner's Use

5 Fig. 4 shows apparatus used to determine the rate of reaction between zinc and dilute sulphuric acid

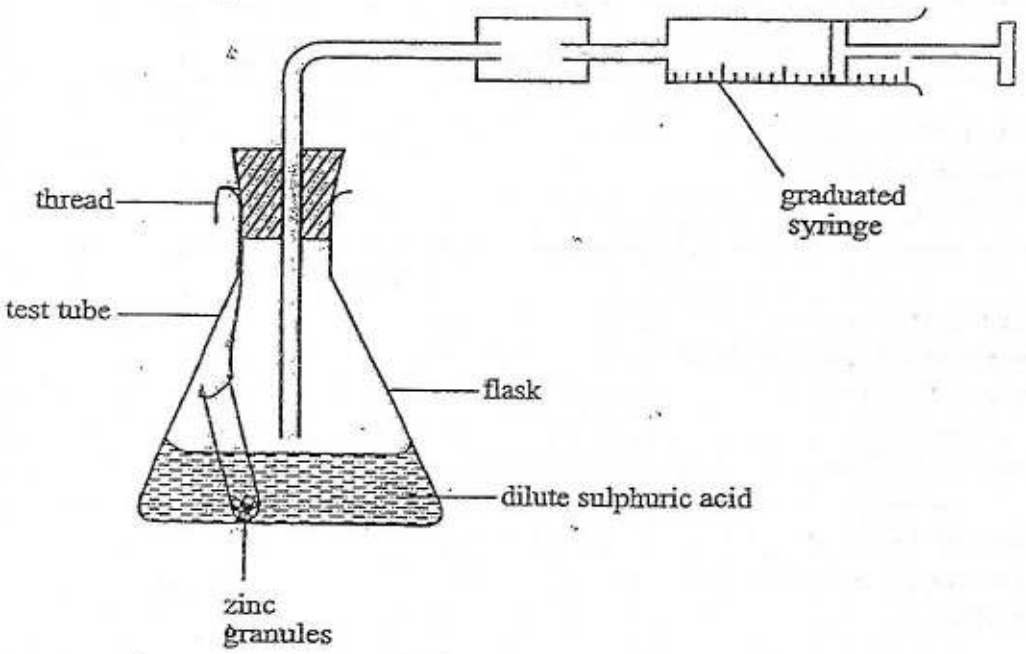


Fig. 4

(a) Why was zinc introduced in a test tube into the flask?

_____ [1]

(b) Suggest how the reaction was started?

_____

_____ [1]

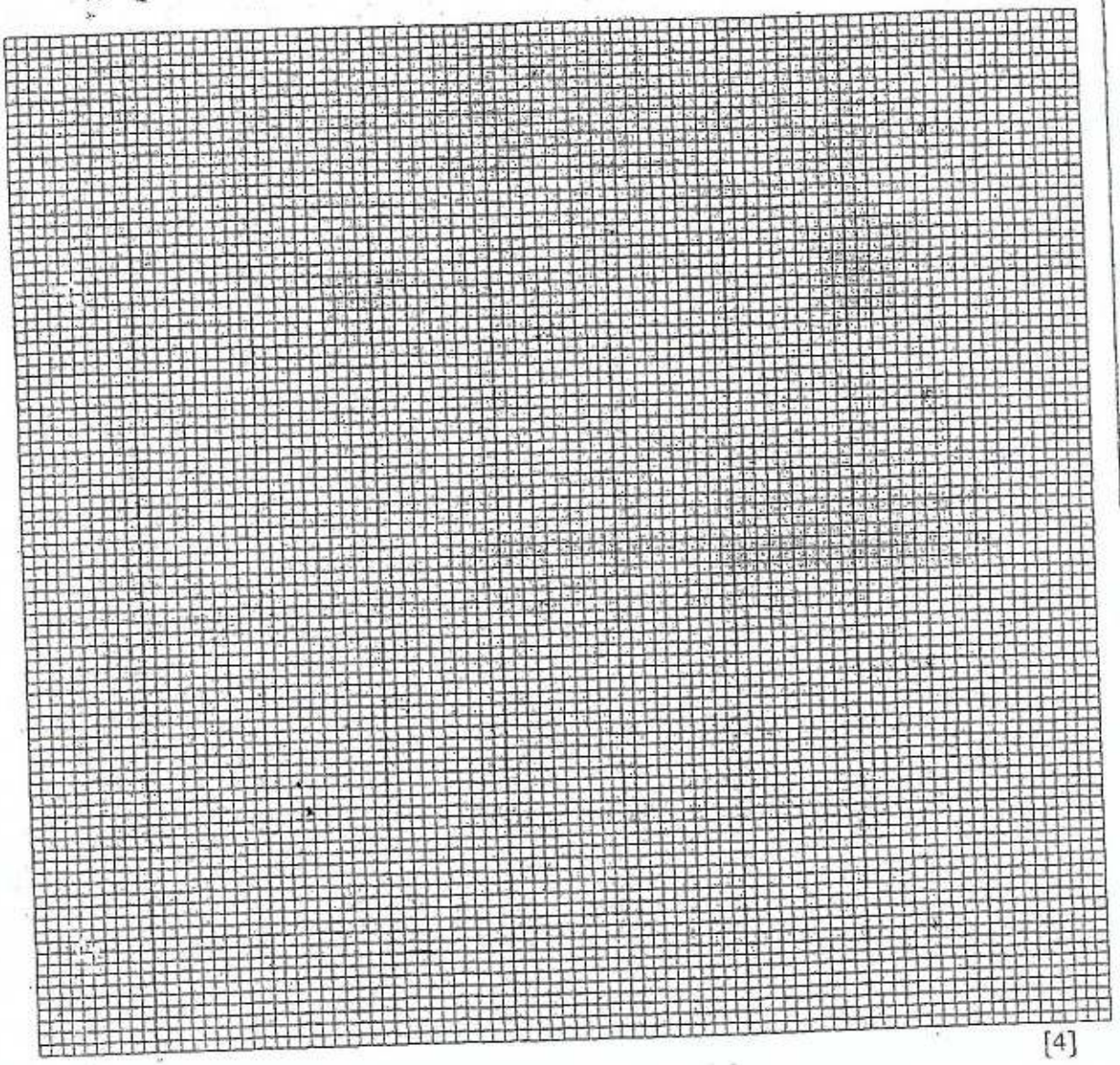
(c) The volume of gas collected every minute was recorded in **Table 3.**

Table 3

time/min	0	1	2	3	4	5	6	7	8
volume of gas/cm^3	0	15	24	30	35	36	40	40	40

For Examiner's Use

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



[4]

(ii) Put a circle around the point on your graph that seems to be incorrect. [1]

(iii) During which period was the reaction fastest?

_____ [1]

(d) (i) Name the gas given off in the experiment.

_____ [1]

For Examiner's Use

(ii) Describe a test for the gas named in **(i)**.

Test _____

Observation _____

_____ [2]

(e) On the same axes sketch a graph that would be obtained if the experiment is repeated using the same mass of powdered zinc. [2]

[Total: 13]

55

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2012

CHEMISTRY 5071/4

L13 56

1 Labelled terminals. [1]

(a) Arrow from negative to positive [1]

(b) (i) bulb lights

(ii) bulb light is dimmer than with zinc. [1]

(iii) bulb light is brighter than with zinc. [1]

(c) (i) a smelling liquid collected in experiment 2. [1]

(ii) ensure that pure ethanol is collected separate ethanol from water/AW; [1]

(iii) use a fractionating column [1]

2 (a) (i) arrow showing water in; [1]

arrow showing out; [1]

(ii) distillation

(iii) maintain temperature of water (- bt) vapours [1]

(b) colourless odourless liquid collected in beaker:

vapour in flask: [1]

which marks to condenser; [1]

intense blue colour in flask;

volume of solution in flask decreases; (any three)

3 (a) (i) methyl orange/ phenophthalein indicator [1]

(ii) methyl orange is colourless in acid

- orange in alkali [2]

phemolphthlein is colourless in acid

- red in alkali [2]

114

Titration No.	1	2	3
final	20.9	41.3	38.5
initial	0	21.0	18.10
vol.	20.9	20.3	20.4

$$\frac{20.4 + 20.3}{2}$$

25.0cm^3 of solution M required 20.35 cm^3 of N.

(c) (i) $0.24 \times \frac{\text{titre}}{1\cdot000}$ [1]

(ii) $\frac{\text{Answer to (i)}}{2}$ [1]

(iii) Answer to (ii) x 106 g. [1]

(iv) $106 \times \frac{1\ 000}{25}$ [1]

(d) (i) 28.67 – answer to c (iv) [1]

(ii) $\frac{\text{Answer to (i)}}{18}$ [1]

11.5 57

4 (a) Table 2.

Test	Observation	Conclusion
1.	Dissolve in water to form a blue solution [2]	Cu^{2+} ions transition element [1]
2.	blue ppt. insoluble in excess [2]	Cu^{2+} ions [1]
3.	blue ppt. insoluble in excess forming a dark blue solution. [5]	Cu^{2+} ions [1]
4.	blue ppt. A gas with a pungent smell given off [4]	Ammonia gas produced [1]

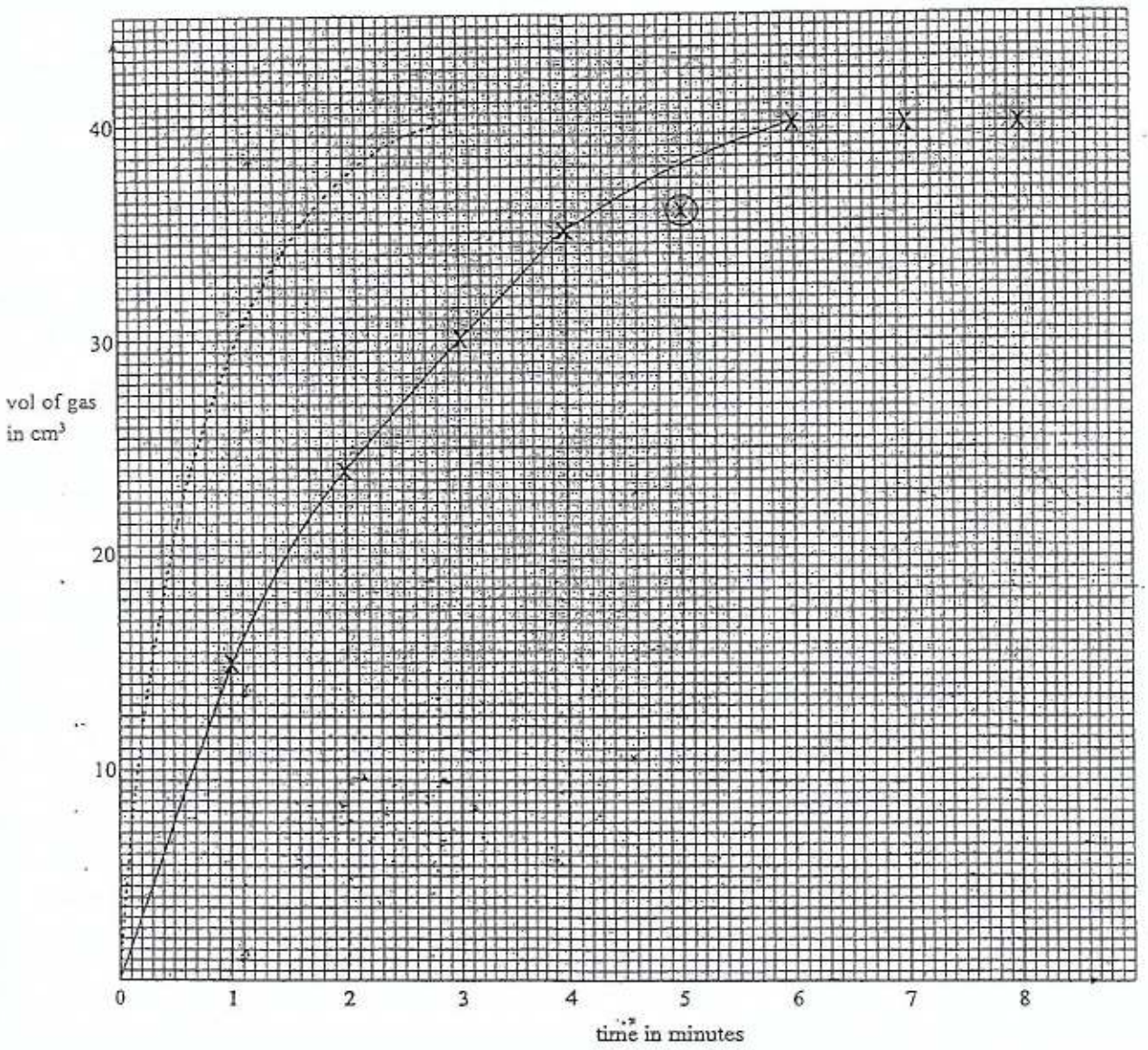
(b) The formula of **P** is $Cu(NO_3)_2$ [1]

5 (a) - obtain accurate results. Gas volumes measured at the start of reaction (AW) [1]

(b) - by tilting flask to allow acid to enter the test tube. [1]

116

(e) (i)



(ii) 0 – 1 min [1]

(iii)

(d) (i) hydrogen gas. [1]

Test

(ii) - insert a burning splint to the mouth of the test tube.

Observation

- burns with a pop sound [2]

17

5 8

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.

114 59

Section A

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

The total mark for this section is 45.

For Examiner's Use

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

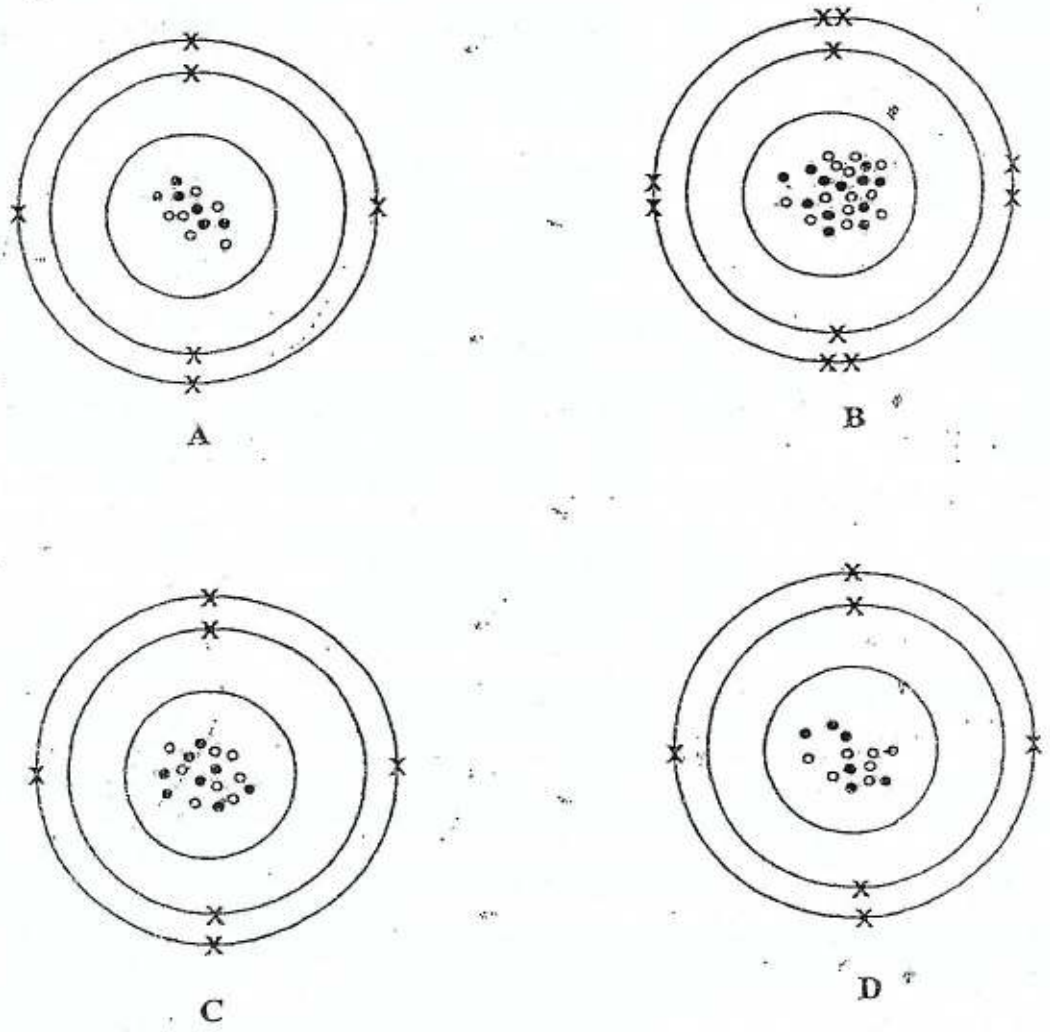


Fig. 1

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

(i) ∘, _____

(ii) •, _____ [2]

1 Re

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]

For Examiner's Use

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.

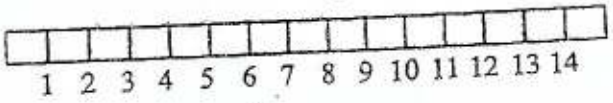


Fig. 2

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

1. lemon juice,

2. toothpaste. [2]

122

For Examiner's Use

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

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.

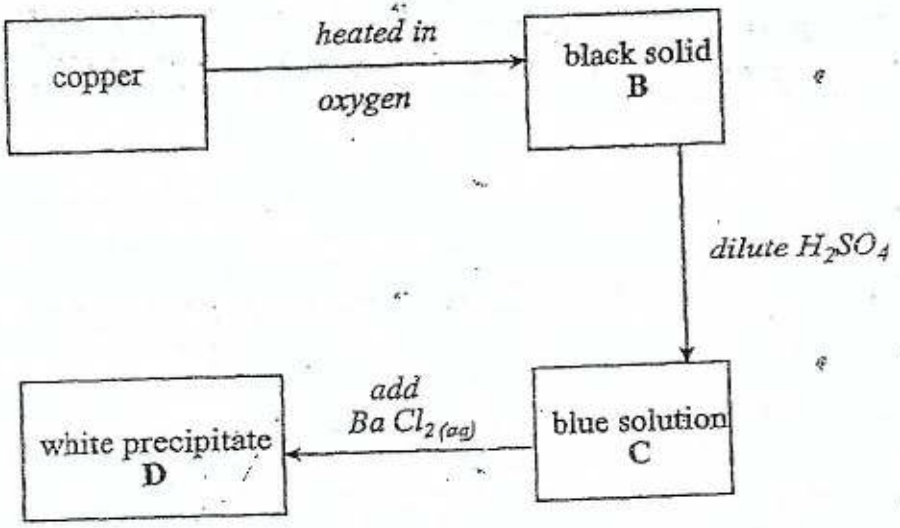


Fig. 3

(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]

124

(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.

For Examiner's Use

[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.

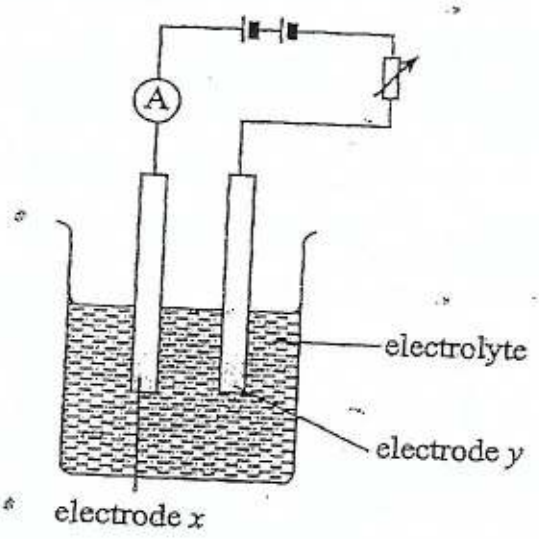


Fig. 4

(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]

126

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.

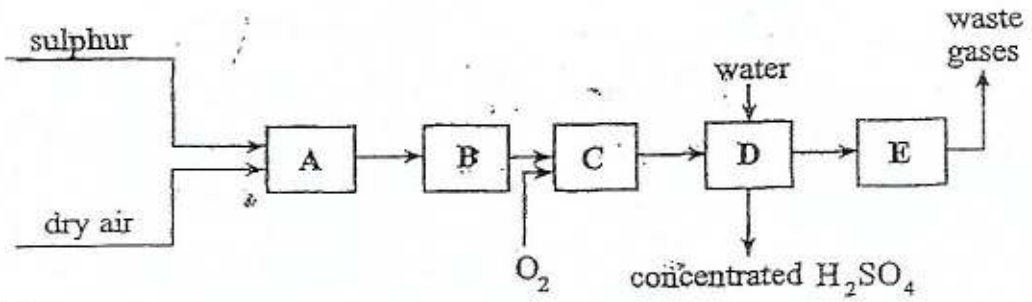
$$2KBr_{(aq)} + Cl_{2(g)} \rightarrow 2KCl_{(aq)} + Br_{2(g)}$$

(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.

*127

(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 $C_{12}H_{26}$.

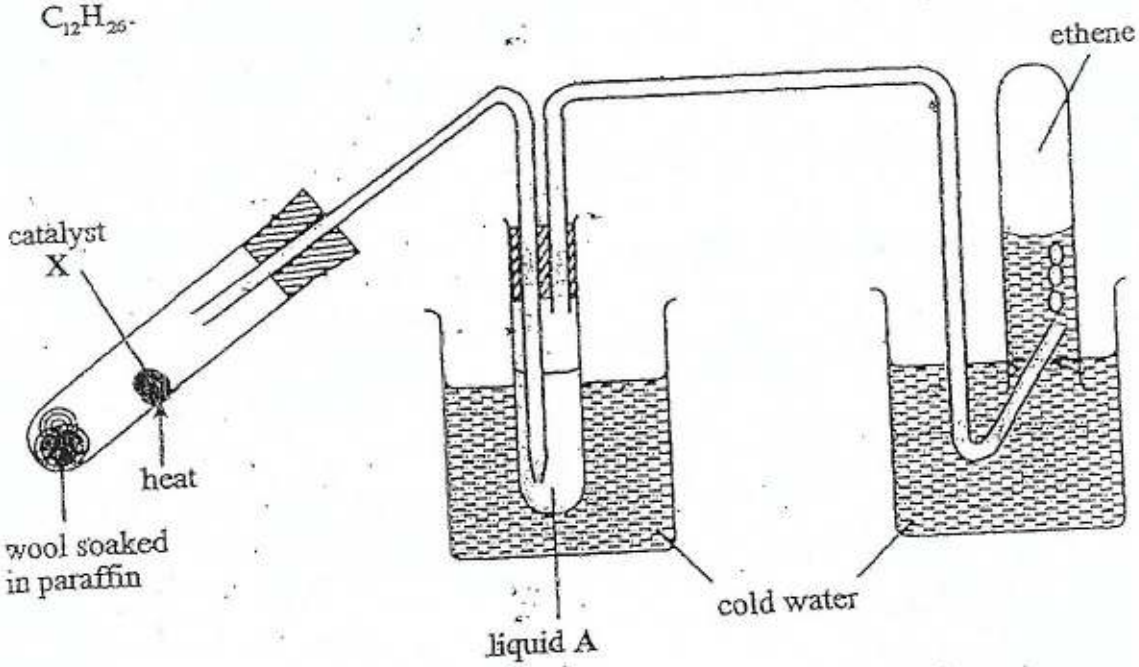


Fig. 6

(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]

128

(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.

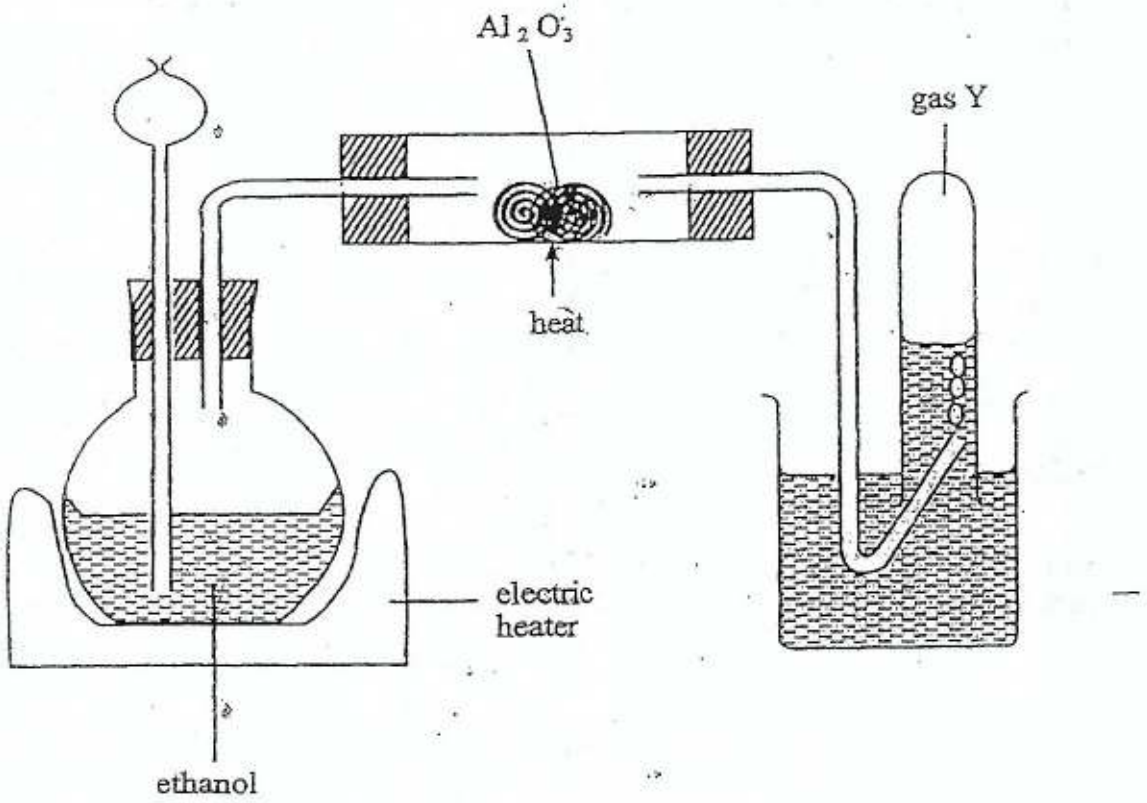


Fig. 7

(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]

125 64

(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]

130

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	163 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 N2013

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2013

CHEMISTRY

5071/2

133

66

1 (a) (i) o protons; [1]

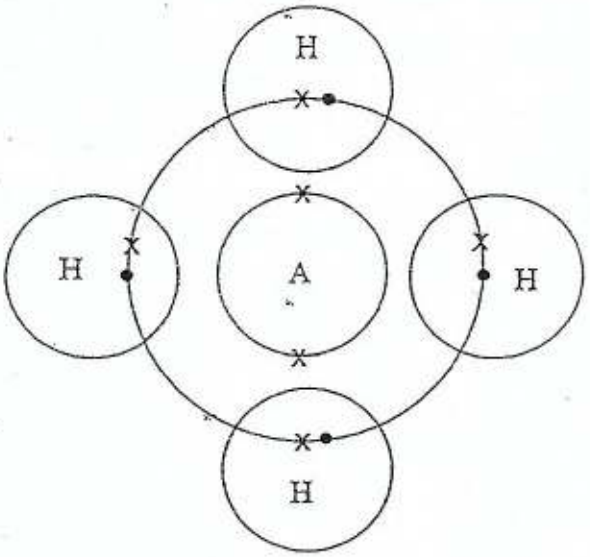
(ii) • neutrons; [3]

(b) A and D [1]

(c) (i) B; [1]

(ii) C; [1]

(d) (i)



(ii) methane; [1]

(iii) low bpt;

insoluble in water; [1]

poor electrical conductor [1]
(any two)

[Total: 10]

2 (a) (i) acidic oxide

$SiO_2 / P_4O_6 / P_4O_{10} / SO_2 SO_3$; [1]

basicoxide
Na_2O/MgO; [1]

Amphoteric oxide
$A\ell_2O_3S$; [1]

(ii) 1. $Al_2O_3^{(s)} + 6HCl_{9aq)} \rightarrow 2AlCl_{3(aq)} + 3H_2O(l)$; [1]

2. $Al_2O_{3(s)} + 6NaOH_{(aq)} + 3H_2O_{(\ell)} \rightarrow 2Na_3Al(OH)_{6(aq)}$ [1]

134

$$Al_2O_{3(s)} + 3H_2O_{(\ell)} + 2NaOH_{(aq)} \rightarrow 2Na[Al(OH_4)_{(aq)}$$

(b) lemon juice pH 3 – 6 ; [1]

toothpaste pH 8 – 10; [1]

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	Fire extinguisher / dry ice / carbonated drinks	
Hydrogen			Burns with a pop sound

[7]

(a) (i) Copper (II) oxide / CuO; [1]

Copper (II) sulphate / $CuSO_4$; [1]

Barium sulphate / $BaSO_4$; [1]

(ii) $Mg + CuO \rightarrow MgO + Cu$; [1]

(iii) redox/reduction – oxidation/displacement; [1]

(iv) $\frac{2,4g}{M_r(Mg)} = 0.1$ moles of Mg; [1]

1:1 reaction →0.1 moles CuO present; [1]

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

$= 80 \times 0.1$ / [1]

$= 8g$;

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

equation [1]

state symbols [1]

4 (a) (i) Cathode: $Pb^{2+} + 2e^- \rightarrow Pb$; [1]

anode : $2Br^- \rightarrow Br_2 + 2e^-$; [1]

electrolyte: $CuSO_{4(aq)}$; [9]

electrode X: graphite / carbon; [1]

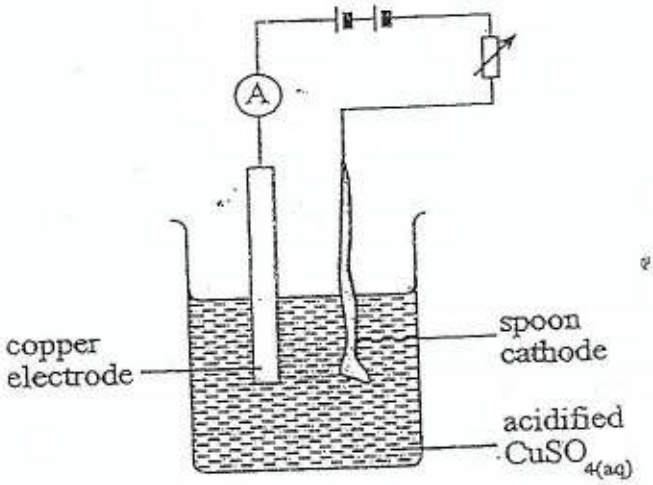
electrode Y: graphite / carbon; [1]

electrolyte: $CuSO_{4(aq)}$; [1]

Anode $Cu_{(s)} \rightarrow Cu^{2+} + 2e^-$ [1]

(ii) red brown vapour produced (at anode); [1]

(b)



[2]

SECTION B

5 (a) (i) Bromine is a liquid whereas iodine is a solid; [1]

bromine has a red – brown colour, iodine is black; [1]

(ii) seven e^- in outer shell; [1]
good oxidising agents;
react by accepting / sharing e^-;AW [2]
(any two)

(iii) Purification of water; [1]
manufacture of plastics pvc; [1]

(ii) electrolysis of molten KBr; [1]

136

(b) (i) 1. Bubbles of gas [1]

2. the solution turns from colourless to red brown; [1]

(ii) redox / displacement; [1]
change in oxidation numbers /
chlorine more reactive displaces bromine; [1]

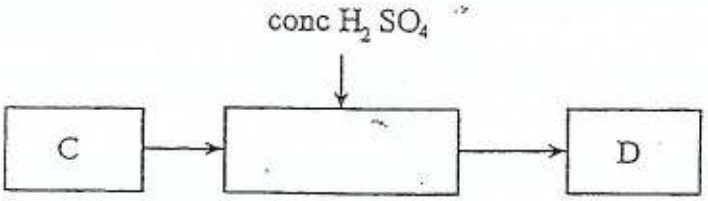
(a) (i) I C; [1]

II E; [1]

III B; [1]

(ii) absorption stage missing /
one stage missing between C and D; [1]

concentrated H_2SO_4 / diagram



[1]

(iii) 1 atm / $450°C$ / V_2O_5 catalyst, (any one); [1]

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ [1]

(b) react sulphuric acid with ammonia; [1]
evaporate; [1]
crystallize. [1]

(a) (i) 1. Cracking; [1]

2. Aluminium oxide / silicon dioxide; [1]

(ii) $C_{10}H_{12}$; [1]

$C_{12}H_{26} \rightarrow C_{10}H_{22} + C_2H_4$; [1]

(iii) bromine is decolourised; [1]

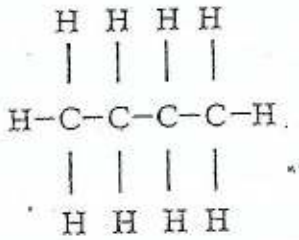
$C_2H_4 \rightarrow CH_2BrCH_2Br$; [1]

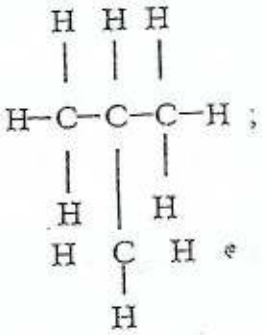
(b) (i) a group of organic compounds with the same general formula and similar chemical properties; [1]

(ii) alkanes; [1]

1 3 9

(iii)





[1]

[1]

8 (a) (i) Ethane;

(ii) $CH_3CH_2OH \xrightarrow[catalyst]{Al_2O_3} CH_2CH_2 + H_2O$; [1]

(iii) ethanol is highly flammable should not be heated with a naked flame; [1]

(b) (i) $CH_2CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$; [1]

(ii) 46g ethanol ≡ 1 mole ; [1]
energy produced by 0.5 moles = 0.5 moles = 0.5 × 1380 Kj

= 690 kJ; [1]

moles CO_2 = 2 × moles ethanol

= 2 × 0.1 [1]

= 1;

Vol CO_2 = number of moles × molar gas vol

= 1 × 28 dm^3

= 28 dm^3 [1]

(iii) ethanol produces (a lot of) heat energy on combustion; [1]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/3

PAPER 3 Practical Test

NOVEMBER 2013 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculators

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 5 printed pages and 3 blank pages.

134 69

For Examiner's Use

1 (a) (i) You are required to classify different types of reactions by carrying out the following experiments.

Experiment 1:

Using a measuring cylinder, place 50 cm^3 of 1 $moldm^{-3}$ sodium hydroxide in a plastic cup. Measure and record its initial temperature in **Table 1.**

Add 2 g of citric acid to the sodium hydroxide in the plastic cup while stirring the mixture with the thermometer.

Measure and record in **Table 1** the lowest/highest temperature reached.

Experiment 2:

Repeat the procedure in experiment 1 using 1 $moldm^{-3}$ copper sulphate and 2 g of magnesium powder. Record your values in **Table 1.**

Experiment 3:

Repeat the procedure in experiment 1 using 0.2 $moldm^{-3}$ hydrochloric acid and 2 g of sodium hydrogen carbonate. Record your values in **Table 1.**

Table 1

Experiment number	1	2	3
Final temperature			
Initial temperature			
Change in temperature			

[6]

(ii) Give **one** other observation made in

1. experiment 2,

_____

2. experiment 3.

_____ [2]

140

For Examiner's Use

(b) Write a balanced chemical equation for the reaction in

1. experiment 2,

_____

2. experiment 3.

_____ [2]

(c) Name the type of reactions occurring in each experiment and give a reason.

Experiment 1 _____

Reason _____

_____

Experiment 2 _____

Reason _____

_____

Experiment 3 _____

Reason _____

_____ [6]

(d) State and explain the effect of

(i) using sodium hydroxide of a higher concentration in experiment 1 given that there is no excess reagent,

effect _____

_____

explanation _____

_____ [2]

(ii) increasing the volume of copper sulphate in experiment 2 given that magnesium is in excess.

effect _____

_____

explanation _____

_____ [2]

[Total: 20]

142

2 Z is a compound containing one cation and one anion.
Carry out the following tests on Z and deduce the cation and anion in Z.

	Test	Observation	Deduction
(a)	Describe the appearance of Z		
(b)	Place Z into a clean boiling tube. Add about 10 cm^3 of distilled water and shake.		
(c)	To a portion of Z		
(i)	add dilute nitric acid, $HNO_3(aq)$ followed by aqueous lead nitrate, $PbNO_3$ (aq)		
(ii)	To a second portion of Z add dilute sodium hydroxide until in excess and then filter Retain filtrate for test (iv)		
(iii)	To a third portion of Z add dilute ammonia, NH_3		
(iv)	To a portion of the filtrate from (ii) add aqueous silver nitrate followed by concentrated ammonia.		

[18]

Cation in Z: _____

Anion in Z: _____ [2]

[Total : 20]

143

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2013

CHEMISTRY 5071/3

145

72

1 (a) (i) Recording all initial temperatures

Recording all final temperatures [3]

All subtractions correct [3] [6]

(ii) 1. Change in colour of copper sulphate

Solution/brown colouring on magnesium; [1]

2. effervesence; [1]

(b) 1. $CuSO_4\,(aq) + Mg(s) \rightarrow MgSO_4\,(aq) + Cu\,(s)$ [1]

2. $NaHCO_3\,(s) + HC\ell\,,(aq) \rightarrow NaC\ell\,(aq) + CO_2(g) + H_2O\,(l)$ [1]

(c) exothermic;/neutralisation, [1]

temperature increases/acid + Base rxtn [1]

exothermic;/displacement/Redox, [1]

temperature increases;/Mg is more reactive; [1]

endothermic; / neutralisation; [1]

temperature decreases / acid base; [1] [6]

(d) (i) no effect; [1]

sodium hydroxide becomes excess; [1]

(ii) higher temperature change; [1]

more moles reacting; [1]

[Total: 20]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/4

PAPER 4 Alternative to Practical

NOVEMBER 2013 SESSION

1 hour

Candidates answer on the question paper.
Additional materials:
Mathematical tables and/or Electronic calculators
Ruler

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
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.
You should use names, **not** symbols, when describing all reacting chemicals and the products formed.

FOR EXAMINER'S USE	
1	
2	
3	
4	
TOTAL	

This question paper consists of 9 printed pages and 3 blank pages.

145 74

1 A student carried out three experiments.

Experiment 1

50 cm^3 of 1 $moldm^{-3}$ sodium hydroxide were placed in a plastic cup. The temperature of the solution was measured.

2 g of citric acid were added to the sodium hydroxide in the plastic cup. The final temperature reached was recorded.

Experiment 2

Experiment 1 was repeated using 1.00 $moldm^{-3}$ copper sulphate and 2 g of magnesium powder.

Experiment 3

Experiment 1 was repeated using hydrochloric acid and sodium hydrogen carbonate.

Fig.1. shows parts of the thermometer stem giving the final temperature for each experiment.

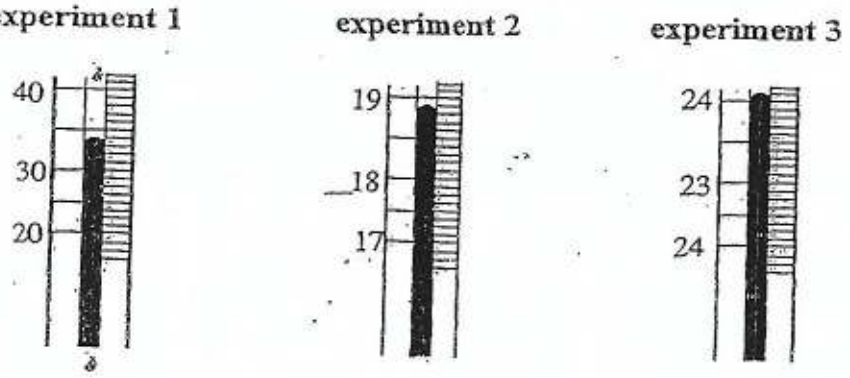


Fig. 1

(a) (i) Use **Fig.1** to complete **Table 1.**

Table 1

experiment number	1	2	3
final temperature/°C			
initial temperature/°C	22	22	22
temperature change			

[6]

For Examiner's Use

For Examiner's Use

(ii) Give **one** other observation made in

1. experiment 2, _____

2. experiment 3. _____

(iii) Write a balanced chemical equation for the reaction occurring in

1. experiment 2,

_____

2. experiment 3.

_____ [2]

(b) Complete **Table 2** by naming with reasons the type of reaction occurring in each experiment.

Table 2

experiment number	1	2	3
type of reaction			
reason(s)			

[6]

(c) State and explain the effect of using sodium hydroxide of a higher concentration in **experiment 1** given that there was no excess reagent.

effect _____

explanation _____

_____

_____ [2]

(d) Given that magnesium was in excess in **experiment 2**, state and explain the effect of increasing the volume of copper sulphate.

effect _____

explanation _____

_____

_____ [2]

153

For Examiner's Use

2 Table 3 shows tests that were carried out on substance Z and the conclusions made from the observations.

Complete Table 3.

Table 3

	Test	Observations	Conclusions
(a)	Z was dissolved in water and portions of solution formed were used for tests (b) and (c)	clear colourless solution	
(b)	To a portion of solution Z dilute nitric acid was added Followed by lead nitrate	no effervesence yellow precipitate	
(c)	To a portion of Z dilute sodium hydroxide was added until in excess.	white precipitate	
	The mixture from test (c) was filtered The filtrate was used for tests (d), and (e)		
(d)	To a portion of the filtrate silver nitrate was added	no change	
(e)	To a portion of the filtrate silver nitrate was added Followed by concentrated ammonia		I^- present

Conclusion

For Examiner's Use

The cation present in substance Z is _____

The anion present in substance Z is _____

The chemical formula of substance Z is _____ [13]

3 A mass of 2 g of magnesium were placed in 25 cm^3 of hydrochloric acid. The amount of the acid that reacted was determined by titrating the acid against 0.98 mol dm^{-3} NaOH, using an indicator.

Table 4 shows the results of the titration.

Table 4

titration number	1	2	3
final burette reading / cm^3	34.60	24.60	42.60
initial burette reading / cm^3		6.00	
volume of NaOH used / cm^3	17.80		18.00
best results			

(a) (i) Complete **table 4.** [3]

(ii) Tick the best titration results. [2]

(iii) **Summary**

25 cm^3 of the hydrochloric acid required _____ cm^3 of sodium hydroxide. [1]

For Examiner's Use

(b) Calculate

(i) the number of moles of sodium hydroxide that reacted with excess acid.

[1]

(ii) number of moles of HCl that remained after reaction with acid.

[1]

(iii) number of moles of HCl that reacted with magnesium.

[1]

(c) Deduce the initial concentration of 25 cm^3 of the hydrochloric acid.

[2]

[Total:10]

4 Fig. 2.1 shows a set up of apparatus that was used to separate and identify samples of unknown amino acids. Fig 2.2 shows results of the investigation.

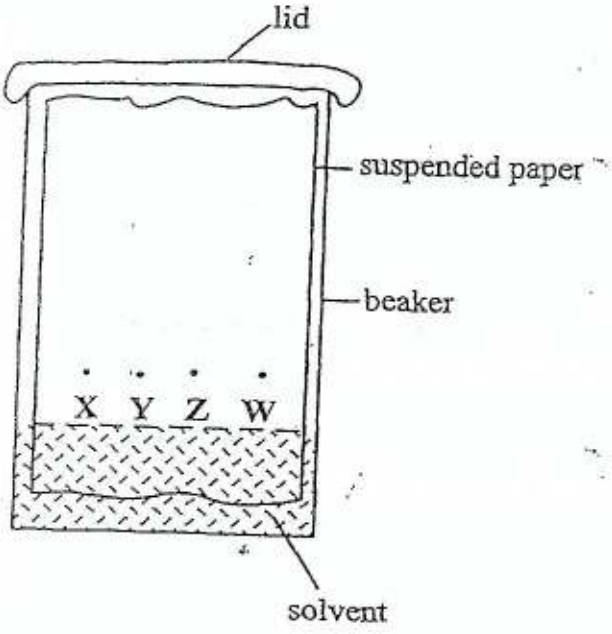


Fig. 2.1

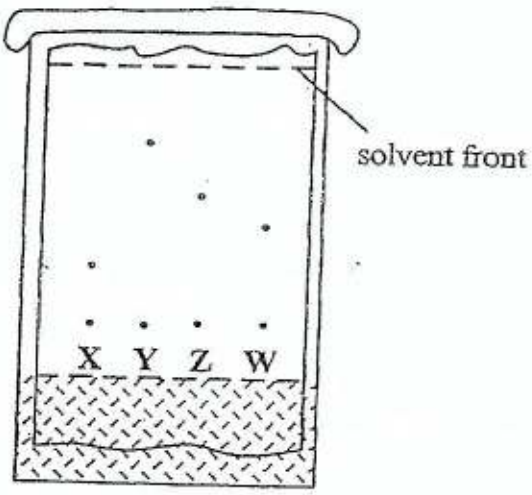


Fig. 2.2

(a) (i) Name the technique used to separate the amino acids.

_____ [1]

(ii) Explain why the beaker was covered with a lid.

_____ [1]

(iii) Name **one** suitable solvent that can be used.

_____ [1]

(b) (i) Using a ruler measure the distance moved by each of the samples X, Y, Z and W.

distance moved by X _____ cm

Y _____ cm

Z _____ cm

W _____ cm [4]

157

78

For Examiner's Use

(ii) Calculate the R_f value for samples **X** and **W**.

1. *sample* **X**

2. *sample* **W**

[4]

(iii) Use data in **Table 5** to identify the amino acids **X**, **Y**, **Z** and **W**.

Table 5

amino acid	R_f value
lysine	0.14
alanine	0.38
glycine	0.26
glutamic acid	0.20

X _____

Y _____

Z _____

W _____

[4]

[Total: 15]

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MARKING SCHEME

—

NOVEMBER 2013

CHEMISTRY 5071/4

154 79

1 (a) (i)

Experiment number	1	2	3
Final	34°C [1]	18.9°C [1]	24.1°C [1]
Initial	22°C	22°C	22°C
Change	12°C [1]	3.1°C [1]	2.1°C [1]

[6]

(ii) 1. Change in colour of blue solution to bromine / brown colouring solid deposited; [1]

2. effervesences; [1]

(iii) $CuSO_4 + Mg \rightarrow MgSO_4 + Cu$; [1]

$HCl + NaHCO_3 \rightarrow NaCl + H_2O + CO_2$; [1]

(b) neutralisation; / exothermic; [1]
acid base reaction; rise in temperature; [1]

exothermic /displacement [1]
rise in temperature / Mg more reactive than copper; [1]

endothermic / neutralisation [1]
decrease in temperature / acid base; [1]

(c) no effect; [1]

sodium hydroxide becomes excess ; no reaction occurs; [1]

(d) higher temperature change; [1]

moles reacting; [1]

[Total: 20]

2 (a) no transition element; [1]

(b) no carbonate present; [1]
I^- present; [1]

(c) $Ca^{2+}, Zn^{2+}, Al^{3+}$ present; [1]
ppt insoluble in excess; [1]
Calcium present; [1]

(d) Ca^{2+} present [1]

(e) yellow ppt; [1]

16

Insoluble in excess; [1]

I^- present; [1]

Ca^{2+}; [1]

I^-; [1]

CaI_2; [1]
[Total: 13]

3 (a) (i) 18.60; [1]

14.60; [1]

17.70 [1]

(ii) ticked 17.80 and 17.70; [1]

(iii) $\frac{17.80+17.70}{2}$/17.75; [1]

(b) (i) $\frac{\text{titre}}{1000} \times 0.98$; [1]

ans; [1]

(ii) ans to (i); [1]

(iii) $\left(\frac{2}{24}\right) \times 2$ [1]

0.167 moles; [1]

(c) (ans to b(iii) + ans to b(ii) $\times \frac{1000}{25}$; [1]

ans; [1]
[Total: 12]

16

80

4 (a) (i) chromatography; [1]

(ii) Prevent solvent from evaporating; [1]

(iii) ethanol / any organic solvent; [1]

(b) (i) 0.84.cm; [1]

2.28 cm; [1]

1.56 cm; [1]

1.20 cm; [1]

(ii) X $\frac{0.84}{6}$; [1]

0.14; [1]

W $\frac{1.56}{6}$; [1]

0.26; [1]

(iii) X is lysine [1]

Y is alamine [1]

W is glycine [1]

Z is glutamic acid [1]

[Total: 15]

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.

163 81

Section A

Answer all the questions in the spaces provided.

For Examiner's Use

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]

164

For Examiner's Use

2. calcium chloride.

(ii) Explain why [2]

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]

165 82

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]

166

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.

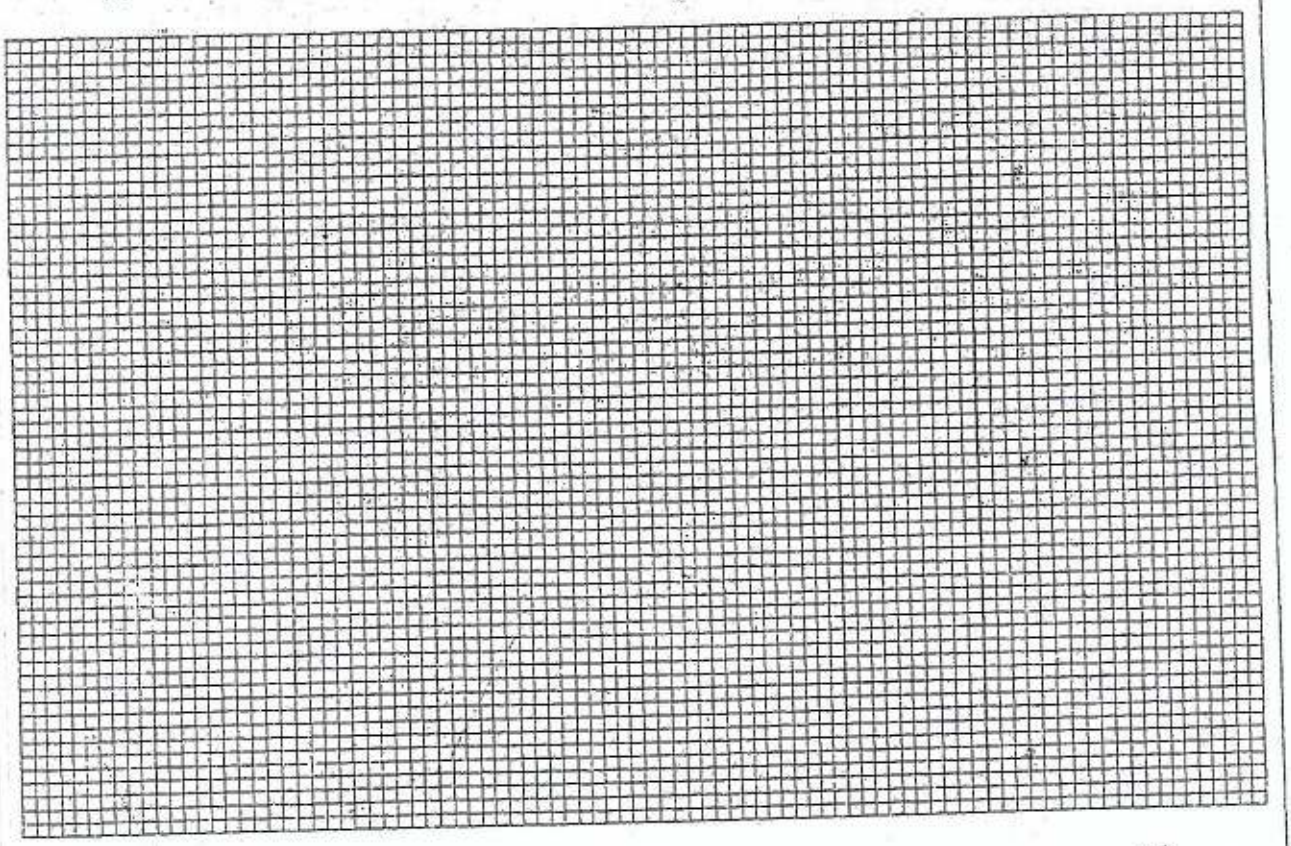
[1]

[Turn over

967 83

For Examiner's Use

(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]

For Examiner's Use

1 t 8

(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]

84

166

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}.

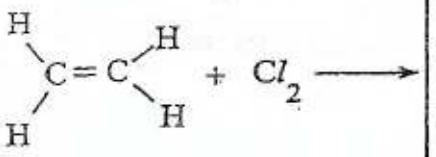
[3]
[Total: 8]

17.0

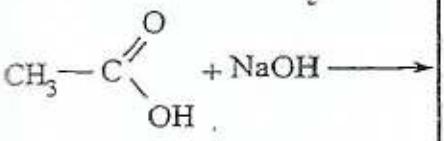
For Examiner's Use

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

(a)

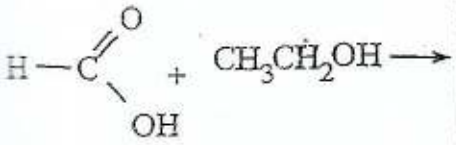


(b)



+ H_2O

(c)



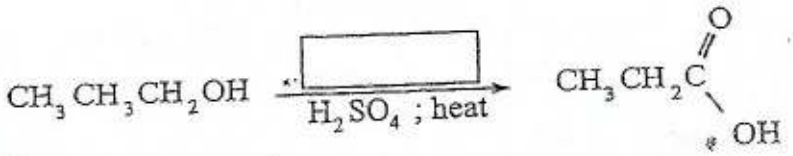
+ H_2O

[Turn over

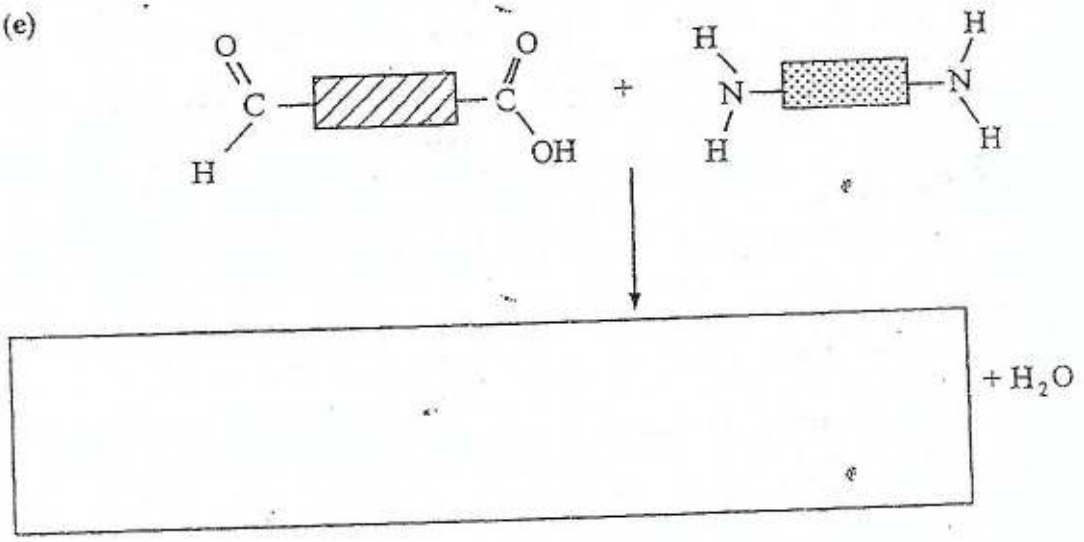
85

171

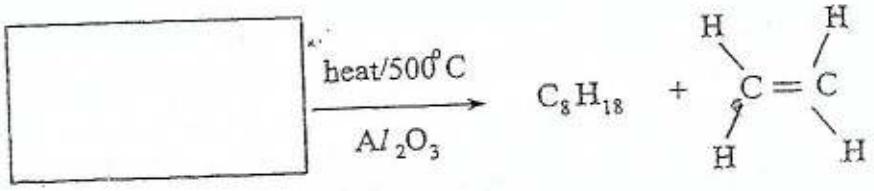
(d)



(e)



(f)



[Total: 6]

172

Section B

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

(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]

R6

173

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

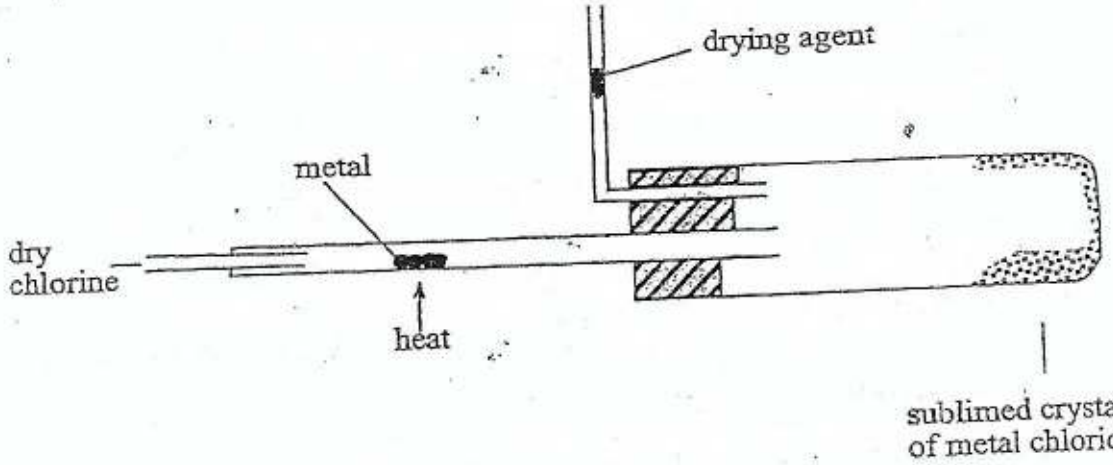


Fig. 1

(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]

174

3 (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]

175 87

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]

176

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	76 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 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 †															

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

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

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 N2014

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General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2014

CHEMISTRY 5071/2

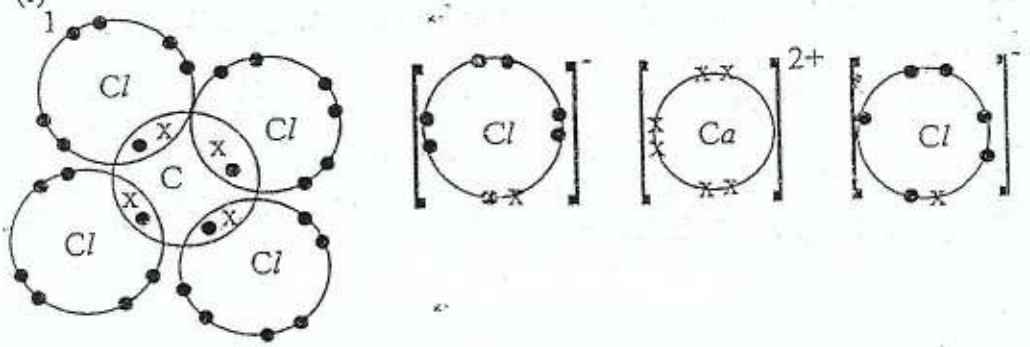
175 89

1 (a)

Name of particle	Number	
protons	17;	[1]
electrons	17;	[1]
neutrons	18;	[1]

(b) A chloride ion has an extra electron/AW; [1]

(c) (i)



[1 mark for correct bonding
1 mark for correct electronic structures] [2 × 2]

(ii) 1. Carbon tetrachloride molecules are held together by weak forces of attraction compared to strong electrostatic forces between $CaCl_2$ particles; [1]

2. CCl_4 has no ions nor free electrons
In solution or moltern form $CaCl_2$ forms mobile ions which
Are responsible for conductivity; [1]
[Total: 10]

2 (a) (i) precipitation; [1]

(ii) redox; [1]

(iii) neutralisation; [1]

(iv) hydrolysis; [1]

(b) (i) (v) represents the oxidation number of chlorine; [1]

(ii) $2\,KClO_3 \rightarrow 2\,KCl + 3O_2$; [1]

150

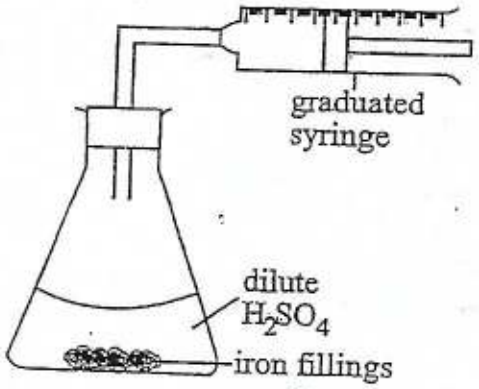
(iii) $n(KClO_3) = \frac{10}{122.5} = 0.08$ moles; [1]

$n(O_2) = \frac{0.08}{2} \times 3 = 0.12$ moles; [1]

$\therefore$ Volume $(O_2) = 24 \times 0{,}12 = 2.88\ dm^3$; [1]

[Total: 9]

3 (a)

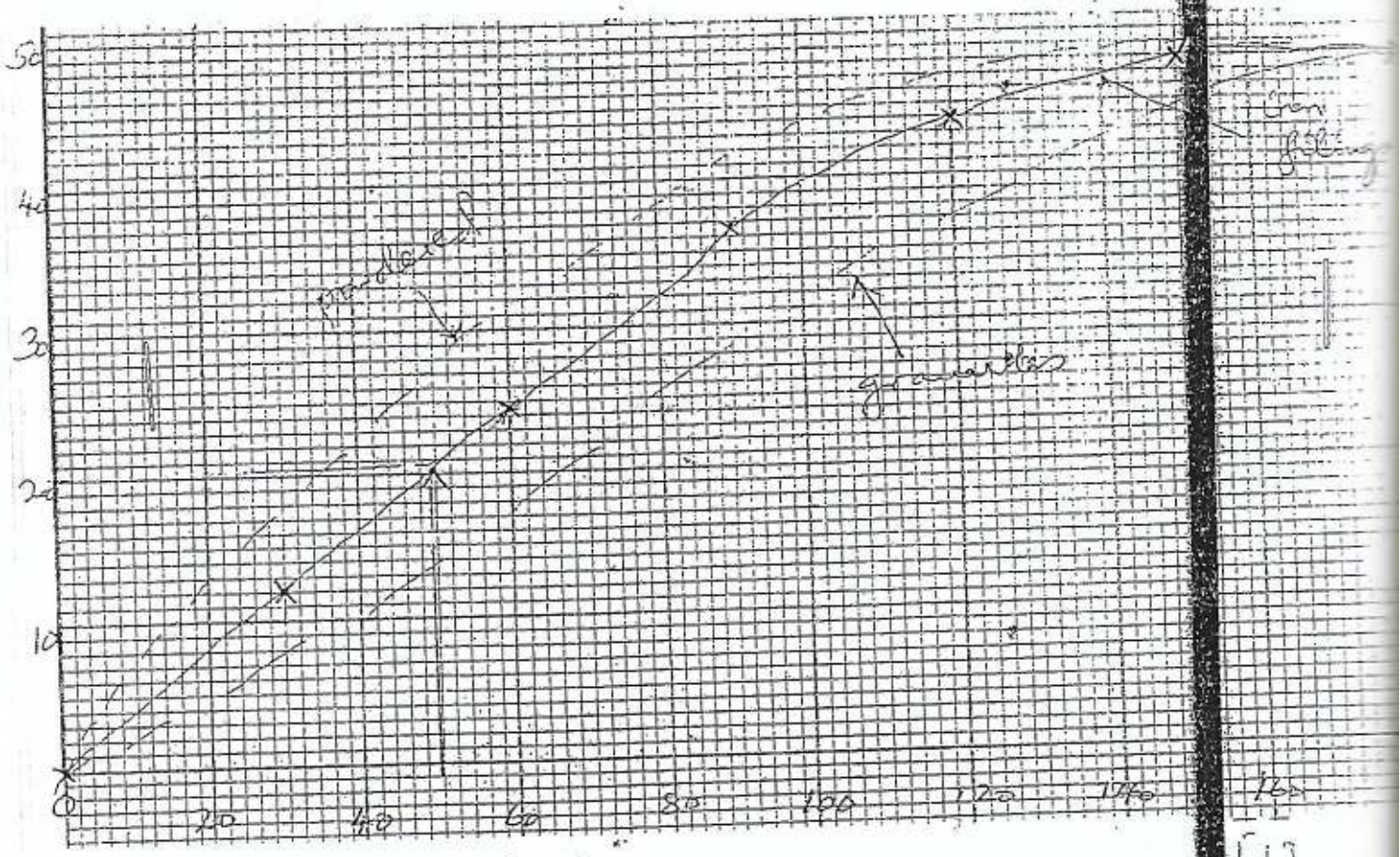


Diagram; [1]
Labels; [1]

(b) $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$; [1]

151 90

(c) (i)



uniform scale ; [1]
correct plotting + joining. [1]
Labelling ; [1]

(ii) Volume at 50 mins = ~~16.3 cm³~~ Read Paul's graph [1]

(iii) Rate = gradient = $\frac{24.67}{60}$/0.411 cm³/min; [1]

(iv) on graph; [2]

182

4 (a) Each carbon atom has a maximum possible number of single bonds around it/AW; [1]

(b) 1. They conform to a general formula; [1]

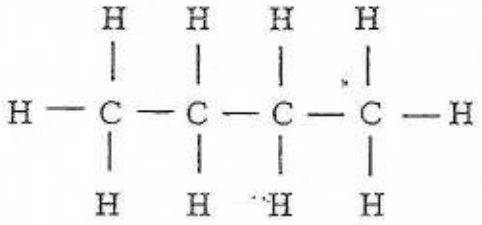
2. They have similar chemical properties; [1]

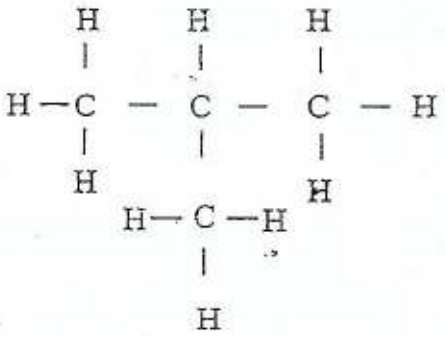
3. They show a gradual change in physical properties; [1]

(c) Cracking/substitution by halogens; [1]

(d) (i) Molecules with the same molecular formulae but different structural formula; [1]

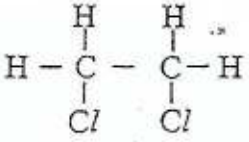
(ii) 1.





[2]

5 (a)



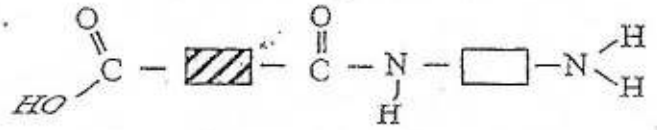
(b) $CH_3COO^-Na^+$; [1]

183 · 91

(c) $HCOOCH_2CH_3$

(d) Potassium dichromate; [1]

(e)

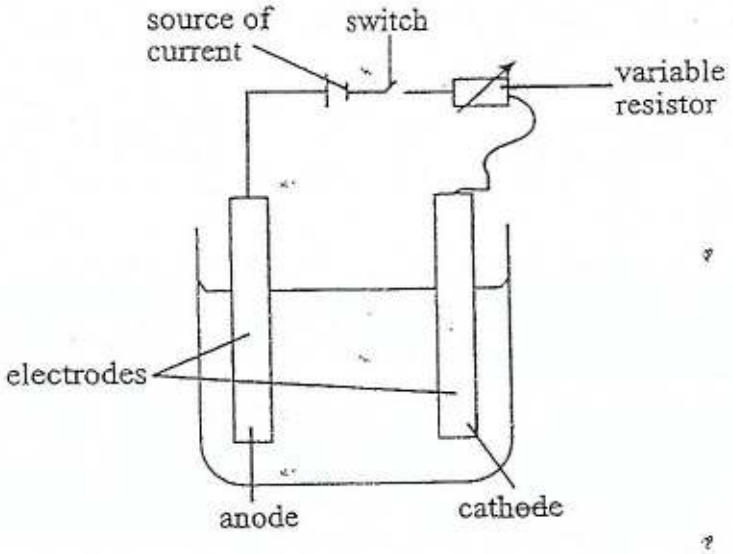


(f) $C_{10}H_{22}$; [1]

[Total: 6]

6 (a) (i) The breakdown of an ionic compound by passing current through its molten or solution form;/AW [1]

(ii)



Diagram; [1]
Labels; [1]

(iii) Cations migrate towards the cathode where they accept electrons and get converted atoms/AW; [1]

Anions migrate to the anode where they give up electrons and get Converted to atoms/AW; [1]

184

(b) (i) Applying a coating of a specific metal on an article (in order to either beautify it or prevent corrosion/AW; [1]

(ii) anode: $Cr_{(s)} \rightarrow Cr^{3+}_{(aq)} + 3e$; [1]

Cathode: $Cr^{3+}_{(aq)} + 3e^- \rightarrow Cr_{(s)}$; [1]

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

Accept equation $4OH^- \rightarrow 2H_2O + 4e^- + O_2$; [2]

[Total: 10]

(a) Anhydrous calcium chloride; [1]

(b) (i) Simplest ratio of atoms in a molecular; [1]

(ii)

Fe	Cl	
$\frac{34.5}{56}$	$\frac{65,5}{35.5}$;	[1]
$\frac{0.62}{0.62}$	$\frac{1.85}{0.62}$;	[1]
1	3	$\therefore FeCl_3$; [1]

(iii) $n(FeCl_3) = n)56 + 35.5 \times 3) = 325 \Rightarrow n\frac{325}{162,5} = 2 \Rightarrow Fe_2Cl_6$ [1]

(iv) $2Fe_{(s)} + 3Cl_{2(g)} \rightarrow Fe_2Cl_6(s)$ [2]

Balance equation: 1 mark
State symbols: 1 mark

(c) Reaction would be more vigorous; [1]

White crystals form; [1]

185 92

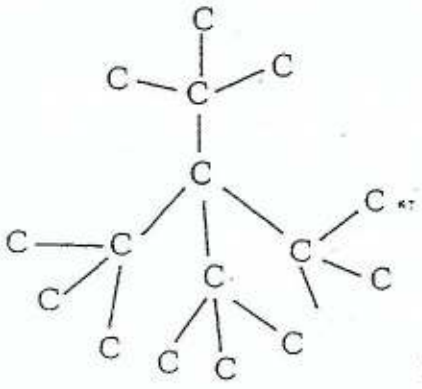
8 (a) (i) Diamond: Each carbon atom is covalently bonded to 4 others and the structure extends in 3 dimensions; [1]

Graphite: Each carbon atom is bonded to 3 others forming hexagonal layers; [1]

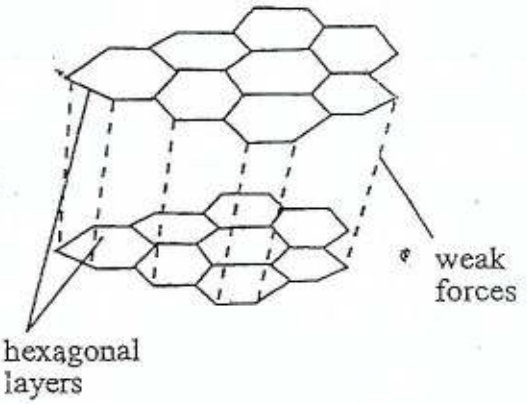
Separate layers are held together by weak forces of attraction; [1]

Accept diagrams

Diamond



Graphite



(ii) Graphite has delocalised electrons along layers hence good conductor where as diamond has no free electrons hence poor conductor; [1]

Layers or graphite can easily slide over each other making graphite relatively soft while rigidity of carbon bonds in diamond make it hard; [1]

Weak forces between layers of graphite make distance between layer larger hence graphite has a lower density; [1]

(b) (i) Natural polymer: protein/starch/cellulose/fats/silk/hair/finger nails; lartex; [1]

Artificial polymer: Nylon (polyamide)/terylene (polyester) plastics; [1]

(ii)

[1]

(iii) They are fire resistant; [1]

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/3

PAPER 3 Practical Test

NOVEMBER 2014 SESSION 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors
Mathematical tables and/or Electronic calculators

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 6 printed pages and 2 blank pages.

189 94

For Examiner's Use

1 One of the drinks manufactured by a bottling company contains citric acid whose formula is shown in **Fig. 1.**

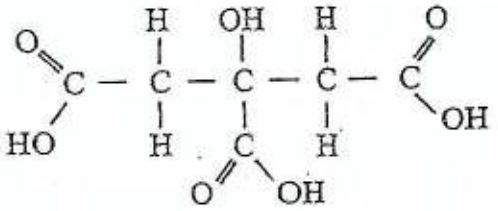


Fig. 1

You are required to determine the percentage composition of citric acid in the drink using a titration method.

(a) Place an empty 100 cm^3 graduated beaker on a balance and record its mass in **Table 1.1.**

Add 100 cm^3 of the drink into the beaker and record its mass in **Table 1.1.**

Table 1.1 Table of weighings

Mass of 100 cm^3 beaker + drink/g	
Mass of empty 100 cm^3 beaker/g	
Mass of 100 cm^3 drink/g	

[2]

150

For Examiner's Use

(b) FA1 is 0.035 moldm $^{-3}$ $NaOH_{(aq)}$.

Pipette 25.0 cm^3 of **FA1** into a conical flask

Add 1 drop of phenolphthalein indicator provided.

Titrate the contents of the conical flask with the drink until a permanent colour change is observed.

Repeat the titration as many times as you consider necessary to obtain accurate results.

Record your results in **Table 1.2.**

Table 1.2: Titration of **FA1** with the drink.

	1	2	3
Final burette reading/cm^3			
Initial burette reading/cm^3			
Volume of drink/cm^3			

[15]

Summary

25.00 cm^3 of **FA1** reacted with _____ cm^3 of the drink.
Show with a tick (✓) which results you used to obtain the volume of the drink.

191 95

For Examiner's Use

(c) Write a balanced chemical equation for the reaction between citric acid and **FA1**.

[1]

(d) Calculate the number of moles of citric acid in the volume which reacted with 25.00 cm^3 of **FA1**.

moles = _____ [1]

(e) Find the mass of citric acid in the titre which reacted with 25.00 cm^3 of **FA1**.

mass = _____ [1]

[Ar: H = 1,0; O = 16,0; C = 12,0]

(f) Calculate the percentage composition of citric acid in the drink.

% = _____ [1]

[Total = 21]

1 52

For Examiner's Use

You are provided with a solution, **FA2**, that contains **one** cation and **two** anions.

Carry out the following tests to identify the ions in **FA2**.

Test		Observation [10]	Deduction [6]
(a)	To a portion of **FA2** add an equal volume of $K_2Cr_2O_{7(aq)}$		
(b)	To a portion of **FA2** add three drops of $Na_2CO_{3(aq)}$		
(c)	To a 1 cm depth portion of **FA2** add an equal volume of $BaCl_{2(aq)}$ followed by $HCl_{(aq)}$		
(d)	To a portion of **FA2** add dilute $NaOH_{(aq)}$ until in excess then add aluminium foil and boil		

Cation in **FA2** is _____ [1]

Anions in **FA2** are 1. _____ [1]

2. _____ [1]

[Total: 19]

193 96

QUALITATIVE ANALYSIS NOTES (5071/3)

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid then add aqueous barium nitrate.	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron (II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron (III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Tests for gases

gas	*test and result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint
sulphur dioxide (SO_2)	turns aqueous potassium dichromate (VI) from orange to green

1 Q 4

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General Certificate of Education Ordinary Level

MARKING SCHEME

NOVEMBER 2014

CHEMISTRY 5071/3

195 97

1 (a) Table 1.1: Table of weighings

- Give one mark for all weighings recorded to 2 d.p [1]
- Give one mark for a correct subtraction [1]

(b) Table 1.2: Titration table

- Give one mark for all readings recorded correct to 2 d.p [1]
- Give one mark for all correct subtractions provided there are no more than one zero starts [1]
- Give one mark for ticked burette reading used and working shown [1]

Accuracy marks

Calculate the difference between supervisor's titre and candidate's titre And assign accuracy marks using the table shown.

Mark	Difference from supervisor/cm^3
12	≤0,05
11	0.05⁺ to 0.10
10	0.10⁺ to 0.15
9	0.15⁺ to 0.20
8	0.20⁺ to 0.25
7	0.25⁺ to 0.30
6	0.30⁺ to 0.35
5	0.35⁺ to 0.45
4	0.45⁺ to 0.55
3	0.55⁺ to 0.75
2	0.75⁺ to 0.95
1	0.95⁺ to 1.50
0	>1.50

The spread penalty is applied using the following table.

Range used/cm^3	Deduction
≤0,200	0
0.20+ to 0.25	1
0.25+ to 0.30	2
0.30+ to 0.35	3
0.35+ to 0.40	4
0.40+ to 0.50	5
0.50+ to 0.60	6
0.60+ to 0.70	7
0.70+ to 0.80	8
0.80+ to 0.90	9
0.90+ to 1.00	10
1.00+ to 1.50	11
>1.50	12

(c) $C_6H_8O_7 + 3NaOH \rightarrow C_6H_5O_7Na + 3H_2O$; [1]

(d) $\frac{0.035 \times 25}{3 \times 1000}$ / moles of $OH^- = \frac{25 \times 0.035}{1000}$ [1]

$$\text{moles of citric acid} = \frac{\text{moles of } OH^-}{3}$$ [1]

(e) 176 × ans(e); [M_r(citric acid) = 176] [1]

(f) $$\frac{\text{ans(f)} \times 100}{\text{Titre} \times \text{mass of 100 cm}^3 \text{ citric acid}} \times 100\%$$ [2]

(g) - antacids neutralise the stomach acids thereby reducing the burning sensation [1]

- beverages contain acids so they increase the acidity of the stomach contents thereby aggreviating the effects of heartburn [1]

147 98

2

Test	Observation	Deductions
(a) $+K_2Cr_2O_{7(aq)}$	no observable change [1]	
(b) $+Na_2CO_3$	effervescence/bubbles [1] ®-gas produced	H+ present/ Acid present [1]
(c) $+BaCl_{2(aq)}$ $HCl_{(aq)}$	white ppte [1] insoluble [1]	SO_4^{2-} present [1]
(d) $+NH_{3(aq)}$ In XS	white ppte [1] insoluble [1]	Al^{3+}, Zn^{2+} [1] Al^{3+} confirmed [1]
(e) +NaOH In XS +Al foil boil	white ppte [1] soluble [1] effervescence/bubbles [1] with a pugent smell [1] turns damp red litmus blue [1]	Al^{3+} confirmed [1] NO_3^- present [1]

Cation in FA2 Al^{3+} 1 mark

Anions in FA2 SO_4^{2-} 1 mark

NO_3^- 1 mark

[Total: 20]

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

CHEMISTRY 5071/4

PAPER 4 Alternative to Practical

NOVEMBER 2014 SESSION 1 hour

Candidates answer on the question paper.
Additional materials:
Mathematical tables and/or Electronic calculators
Ruler

Allow candidates 5 minutes to count pages before the examination.

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
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.

You should use names, **not** symbols, when describing all reacting chemicals and the products formed.

This question paper consists of 10 printed pages.

(CG 99

Centre Number	Candidate Number

1 Fig. 1.1 shows the displayed structural formula of citric acid, a component of drinks manufactured by a bottling company.

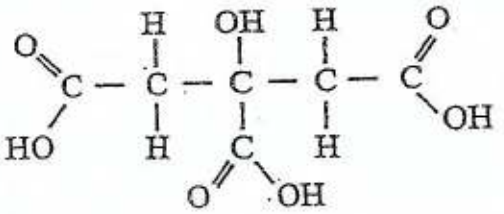

Fig. 1.1

The amount of citric acid present in one of the drinks was determined using a titration method.

Fig. 1.2 shows the volumes of the drink that reacted with 25.00 cm^3 of 0.035 $moldm^{-3}$ NaOH.

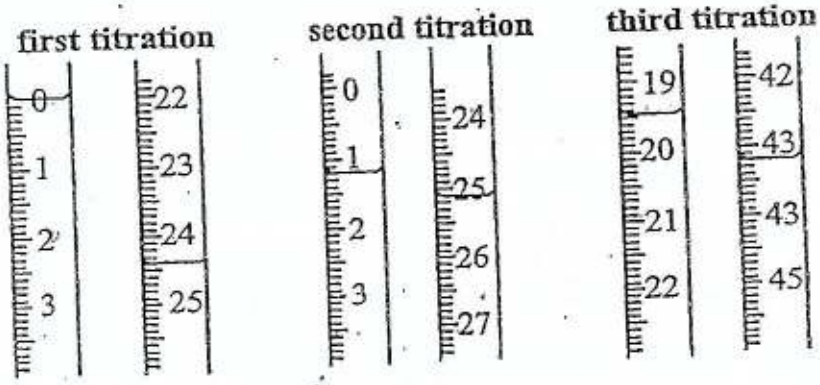

Fig. 1.2

(a) Read and record, in **Table 1**, the volumes of the drink that reacted.

Table 1

	1st titration	2nd titration	3rd titration
Final burette reading/cm^3			
Initial burette reading/cm^3			
Volume of acid used/cm^3			

Tick the best titration results.

200

1 (a) **Summary**

25.00 cm^3 of NaOH required _____ cm^3 of the drink. [4]

(b) (i) Write the empirical formula of citric acid.

_____ [1]

(ii) Name the homologous series of organic compounds, to which citric acid belongs.

_____ [1]

(iii) Write a balanced chemical equation for the reaction between citric acid and NaOH.

_____ [2]

(c) (i) Calculate the number of moles of

1. NaOH in the 25 cm^3,

2. citric acid in the volume that reacted with the NaOH.

[4]

207 100

1 (c) (ii) Calculate the mass of citric acid in the volume that reacted with the NaOH.

[2]

(iii) Calculate the percentage composition of citric cid in the drink, given that 100 cm^3 of the drink weighs 105 g

[2]
[Total: 16]

2 FA2 contains **one** cation and **two** anions from the following list:

Al^{3+}; Ca^{2+}; Cu^{2+}; Fe^{2+}, Fe^{3+}; NH_4^+; Zn^{2+}; Pb^{2+}
Br^-; Cl^-; CO_3^{2-}; I^-; NO_3^-; SO_4^{2-};

The following tests were carried out to identify the ions present in FA2.
Study the table and fill in the missing tests, observations and deductions.

Test		Observation	Conclusion	
(a)	To a portion of FA2 four drops of $Na_2CO_{3(aq)}$ were added	_____ _____	Acid present	[2]
(b)	To a portion of FA2 $BaCl_{2(aq)}$ was added Followed by $HCl_{(aq)}$	_____ _____	SO_4^{2-}, SO_3^{2-} may be present SO_4^{2-} confirmed	[2]
(c)	To a portion of FA2 dilute $NH_{3(aq)}$ was added until in excess	white ppte formed insoluble in excess	_____ _____	[3]
(d)	_____ _____ Aluminium foil was added _____	white ppte formed soluble in excess _____ _____ _____	_____ _____ NO_3^- present	[9]
(e)	To a portion of FA2 an equal volume of $Pb(NO_3)_{2(aq)}$ was added followed by dilute $HNO_{3(aq)}$	_____ _____	_____	[3]

2 (f) Cation in FA2 _____

Anions in FA2 _____ and _____ [3]

[Total: 22]

3 Fig. 2.1 shows a sodium chloride stone used in the extraction of chlorine.

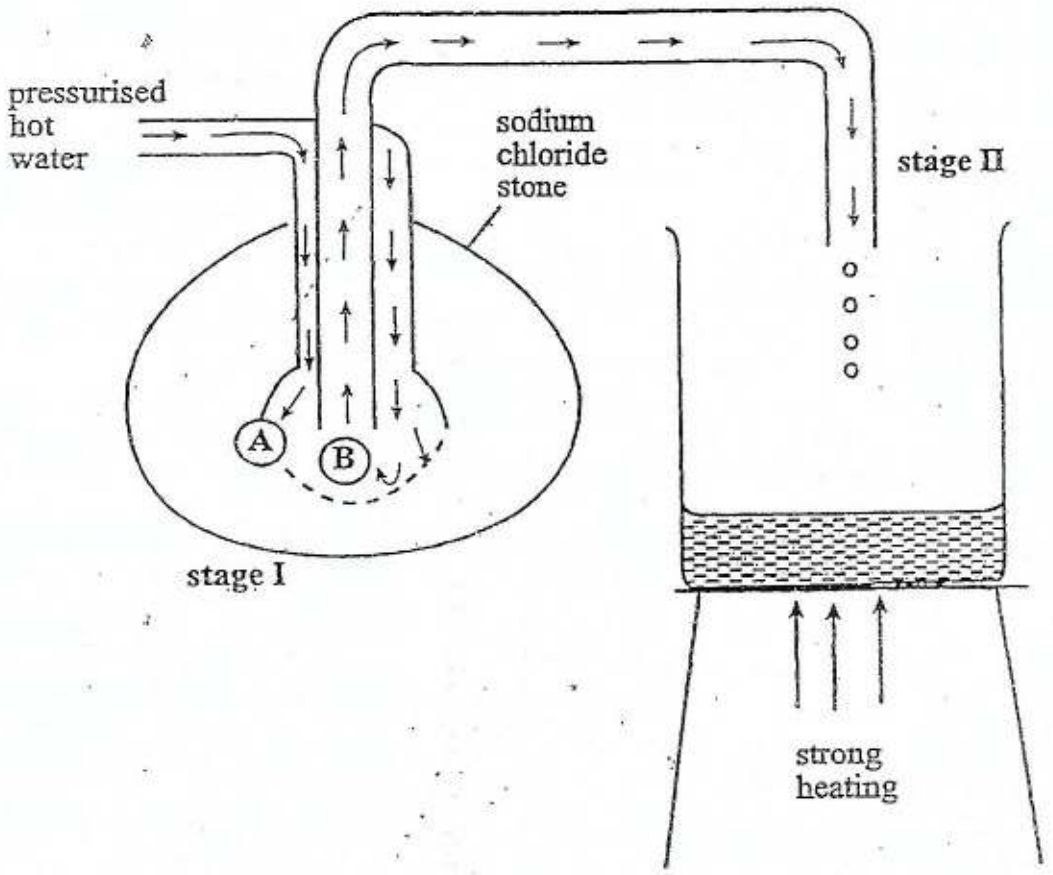

Fig. 2.1

(a) Name the process taking place at

(i) point A, _____

(ii) point B. _____ [2]

(b) Suggest a reason for using hot water instead of cold water.

_____ [1]

204

3 (c) (i) What is the purpose of heating the solution strongly at stage II.

_____ [1]

(ii) List the cations and anions in the resultant concentrated sodium chloride.

Cations _____ *and* _____

Anions _____ *and* _____ [4]

(d) Fig. 2.2 shows the experimental set-up for the electrolysis of the concentrated sodium chloride.

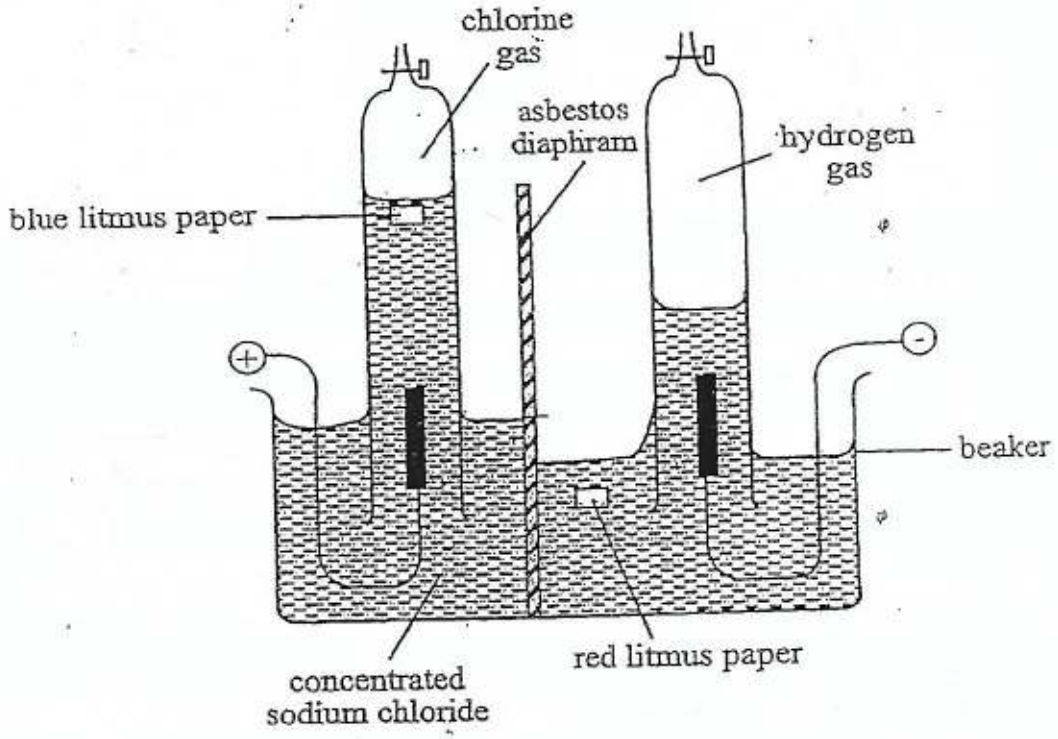

Fig. 2.2

3 (d) (i) The blue litmus paper turned red and then white. Explain.

Turning red _____

_____

Turning white _____

_____ [2]

(ii) The red litmus paper changed to blue. Explain.

_____ [1]

(e) (i) The cathodic reaction is: $2H^+ + 2e^- \rightarrow H_2$

Name, with a reason, this type of reaction.

Type of reaction _____

Reason _____ [2]

(ii) The anodic reaction is $2Cl^- \rightarrow Cl_2 + 2e^-$.

Name, with a reason, this type of reaction.

Type of reaction _____

Reason _____ [2]

(f) Suggest why Cl^- are selectively discharged at the anode in preference to OH^-.

_____ [1]

[Total: 16]

Centre Number	Candidate Number

4 **Fig. 3** is a set up of apparatus used to investigate the gas which causes rusting of iron.

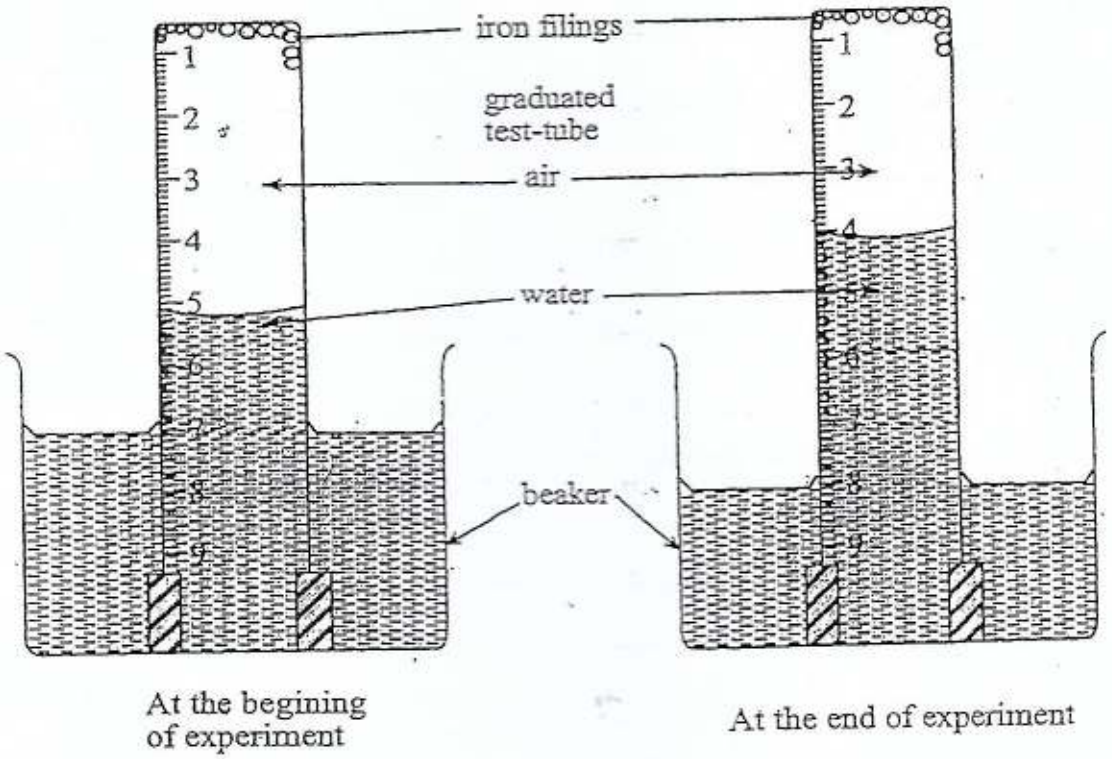

Fig. 3

(a) Record in **Table 2**, the volume of air in each test tube.

Table 2

volume of air at the beginning of experiment/cm^3	
volume of air at the end of experiment/cm^3	
volume of air used for rusting/cm^3	

[3]

Centre Number	Candidate Number

4 **Fig. 3** is a set up of apparatus used to investigate the gas which causes rusting of iron.

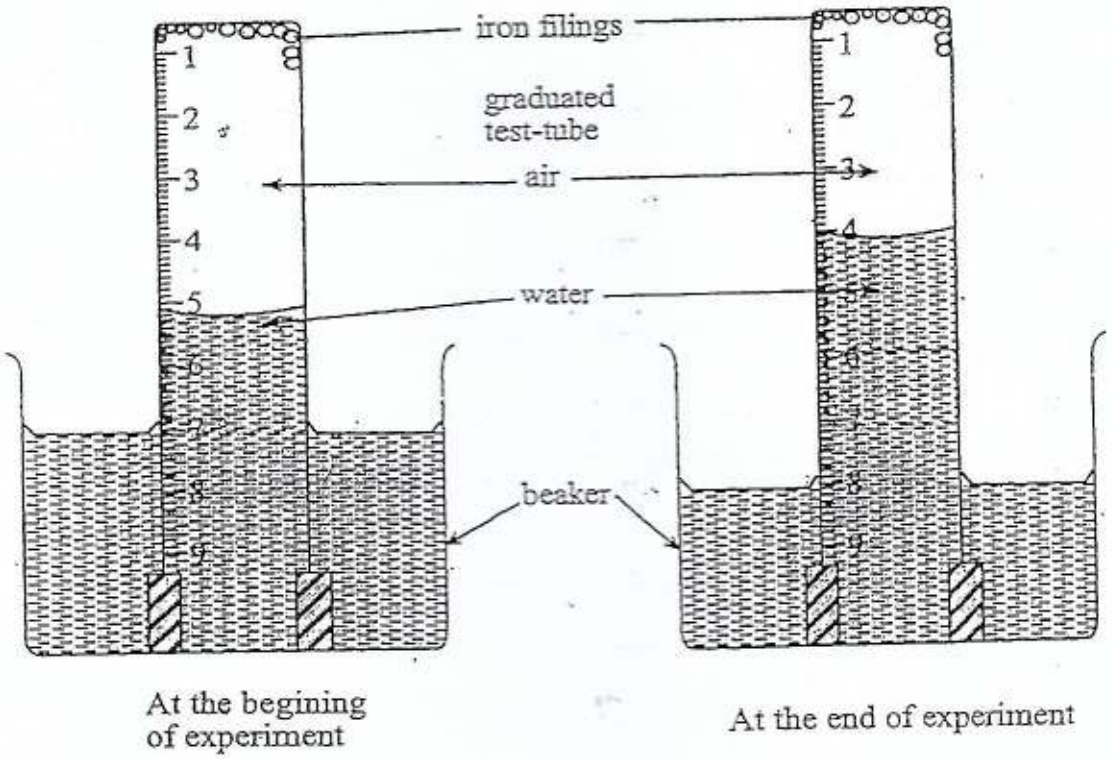

Fig. 3

(a) Record in **Table 2**, the volume of air in each test tube.

Table 2

volume of air at the beginning of experiment/cm^3	
volume of air at the end of experiment/cm^3	
volume of air used for rusting/cm^3	

[3]

(a) Table 1

1 mark for initial and final readings recorded to 2 d.p;

1 mark for all correct subtraction

1 mark for ticking the best titration result.

1 mark for Completing summary [4]

(b) (i) $C_6H_8O_7$ [1]

(ii) carboxylic acid [1]

(iii) $C_6H_8O_7 + 3NaOH \rightarrow C_6H_5O_7Na_3 + 3H_2O$

(1) mark for correct products
(1) mark for balancing equation [2]

(c) (i) 1. $[\,] = \frac{\text{moles}}{\text{volume}}$; [1]

$\frac{0.07 \times 25}{1000}$/0,00175 moles; [1]

2. $\frac{\text{moles of NaOH}}{3}$ / $\frac{0.00175}{3}$; [1]

ans; [1]

(ii) M, citric acid = 176; [1]

$\frac{0.00175}{3}$(moles of citric acid) $\times$ 176(M_r);

ans; [1]

(iii) $\frac{\text{ans c(ii)} \times 100}{\text{titre} \times \text{mass of } 100\text{cm}^3 \text{ citric acid}} \times 100\%$ [1]

ans; [1]

[Total: 16]

21C

2

Test	Observation	Deduction
(a) $+Na_2CO_3$	Effervescence/bubbles turns lime water milky (1)	⊕ gas produced (1)
(b) $+BaCl_2$ HCl	White ppte (1) Insoluble (1)	
(c) +dil $NH_{3(aq)}$ until XS		Al^{3+}, Zn^{2+} (1) (1) Al^{3+} confirmed (1)
(d) Add NaOH to FA2 (1) until XS (1) Add Al then boil (1)	Effervescence/bubbles; with pungent smell turn damp red-litmus blue;	(1) Al^{3+}/Ca^{2+} present (2) (1) Al^{3+}confirmed (1) (1)
(e) $+Pb(NO_3)_2$ $+HNO_3$	White ppte (1) Insoluble (1)	SO_4^{2-} (1)

(f) Cation in FA2 Al^{3+} [1]

Anions in FA2 SO_4^{2-} and NO_3^- [2]

[Total: 22]

3 (a) (i) de-solution/dissolving [1]

(ii) high pressure forcing solution up [1]

(b) increases solubility [1]

(c) (i) To concentrate the solution by evaporating water [1]

(ii) Cations: Na^+ and H^+ [2]

Anions OH^- and Cl^- . [2]

(d) (i) Turning Red: Cl_2 is acidic in water [1]
Turning white Cl_2 bleaches [1]

(ii) Reason: OH^- concentration increasing [1]

(e) (i) Reduction reaction [.]
electrons are gained/decrease in oxidation number [.]

(ii) oxidation reaction [.]
electrons are lost/increase in oxidation number [.]

21

105

(d) State and explain the effect of

(i) using sodium hydroxide of a higher concentration in experiment 1 given that there is no excess reagent,

effect _____

_____

explanation _____

_____ [2]

(ii) increasing the volume of copper sulphate in experiment 2 given that magnesium is in excess.

effect _____

_____

explanation _____

_____ [2]

[Total: 20]

2 12