Candidate Name _____

Centre Number	Candidate Number

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Science 5124/3

Paper 3 Practical Test

Friday **14 JULY 2017**

Additional Materials:

Electronic calculator (non programmable) and / or Mathematical tables
Soft clean eraser
Soft pencil (type B or HB is recommended)
Graph paper

Time **1 hour 30 minutes**

Instructions to Candidates

Write your **name, centre number** and **candidate number** at the top of this page and on all separate answer paper used.

There are **four questions** in this question paper divided into sections **A** and **B**.

Answer all questions by writing your answers in the spaces provided in this 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 are on page 9.

The **Periodic Table** is on page 10.

Cell phones are not allowed in the Examination room.

Question		Examiner's Use
Section A	1	
	2	
Section B	3	
	4	
Total		

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This question paper consists of 10 printed pages

Section A (PHYSICS) [20 marks]

Answer all questions in this section

1 In this experiment you are required to determine the refractive index of water.

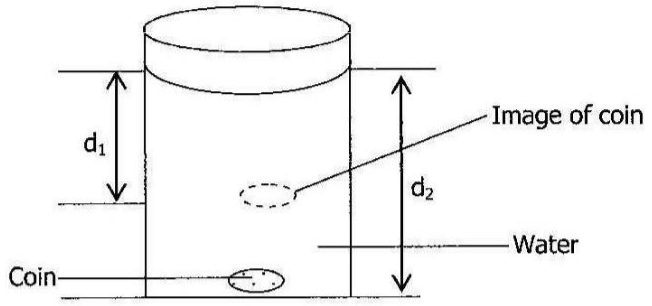


Figure 1.1

(a) **(i)** Place a coin centrally inside the beaker as shown in ***figure 1.1.***

(ii) Pour some water into the beaker to approximately half full.

(iii) Mark using a white board marker, the level of water.

(iv) Using a ruler, measure and record this depth of water as D_1.

D_1 = ... cm

(b) **(i)** View the coin from the top of the beaker and mark besides the beaker the apparent position of the coin.

(ii) Using a ruler, measure the apparent depth and record it as d_1.

d_1 = ... cm [1]

(iii) Calculate the ratio D_1/d_1. .....

..... [2]

(c) **(i)** Add more water until the beaker is almost full.

(ii) Repeat steps **(a) (iii)** to **(b) (iii)** to obtain values of D_2 and d_2 then record them.

D_2 = ... [1]

d_2 =..... [1]

Ratio D_2/d_2 = ... [1]

(d) Determine the average of the two ratios.

Average ratio = ... [2]

(e) Mention **one** possible source of error in this experiment.

.....

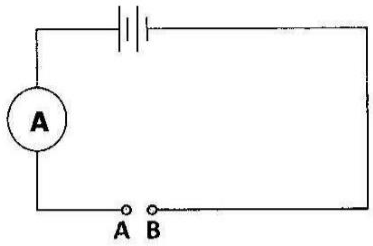
.....

.....

..... [1]

[Total: 10 marks]

2 In this experiment, you will investigate the effect of length of conductor on the resistance of the conductor. You are provided with 5 different lengths of nichrome wire measuring 5 cm, 10 cm, 15 cm, 20 cm, and 25 cm. The following incomplete circuit has been set up for you.



(a) **(i)** Connect the 5 cm long nichrome wire between terminals **A** and **B**. Record the current reading on the ammeter in the table below. Repeat the procedure using the 10 cm, 15 cm, 20 cm and 25 cm long pieces of nichrome wire. Record each current reading against the length of the nichrome wire.

Length of wire/cm	5	10	15	20	25
current/A					

[2]

(ii) What happens to the resistance of the nichrome wire as length increases? Justify your answer.

.....

..... [2]

(b) Plot a graph of current against length of conductor. [4]

(c) With the aid of the plotted graph, work out the resistance of nichrome wire of length 18 cm.

.....

..... [2]

[Total: 10 marks]

Section B (CHEMISTRY) [20 marks]

Answer all questions in this section

3 One of the factors that affect the rate of a chemical reaction is the concentration of the reactants.

In this experiment, you will investigate the effect of diluting a reacting solution on the rate of a reaction.

You will use the reaction of magnesium ribbons of the same mass with dilute hydrochloric acid labelled as solution **Y**.

NB: **Y** is 2.0 M HCl. The reaction of HCl and Mg is;

$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$

The time taken for effervescence to stop suggests the rate of the reaction.

You are provided with 3 empty beakers labelled **A**, **B**, **C** and solution **Y**.

(a) **(i)** Measure 50 cm^3, using a measuring cylinder, of solution **Y** and transfer the whole 50 cm^3 into beaker **A**.

(ii) Add 50 cm^3 of distilled water to beaker **B**. Measure and add 50 cm^3 of solution **Y** to beaker **B**.

(iii) Add 150 cm^3 of distilled water to beaker **C**. Measure and add 50 cm^3 of solution **Y** to beaker **C**.

Calculate and record the new concentrations of HCl in beakers **B** and **C** and record your values in Table 3 (Show your working in the space below).

(b) **(i)** Put one of the ribbons in beaker **A** and immediately start your stop watch and determine the reaction time until there is no more of the ribbon. Record the reaction time t_1 in minutes, taken for the whole ribbon to react, in Table 3.

(ii) Put the second ribbon in beaker **B** and also record the time, in minutes taken for the ribbon to react completely as t_2 in table 3.

(iii) Place the third and last ribbon in beaker **C** and record the time taken for the ribbon to react completely as t_3 in table 3.

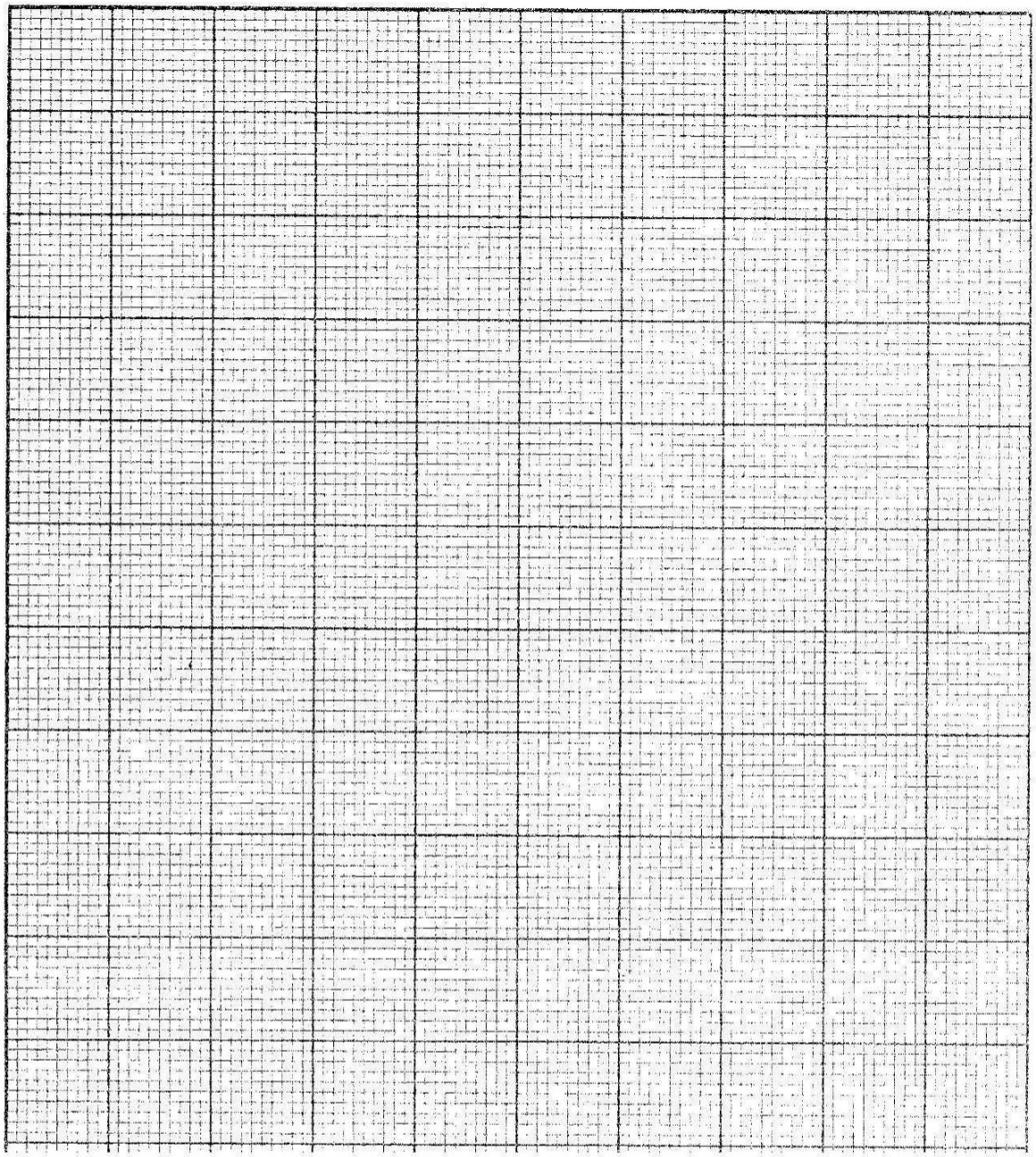
Table 3

Beaker	HCl concentration/mol/dm^3	Reaction time/minutes
A	2.0	
B		
C		

[4]

(c) **(i)** On the grid provided, plot a graph for the three concentrations against t_1,t_2 and t_3. [4]

(ii) Draw a best fit straight line through the 3 points.



Conclusion

1 What is the effect of diluting (reducing concentration) a reacting solution on the rate of the reaction?

.....

..... [1]

2 Which quantity of HCl was **not** changing i.e constant, in beakers **A**, **B** and **C**?

..... [1]

[Total: 10 marks]

4 You are provided with solution **Z** which is a mixture of two salts. Both salts contain the same cations. All the ions are specified in the 5124/3 syllabus.

Carry out the following test on **Z** and record the observations in the table below.

Test and identify any gas evolved.

TEST NO.	TEST	OBSERVATIONS
1	To a small portion of **Z** add an equal volume of acidified silver nitrate solution.	[1]
2	To another small portion of **Z**, add an equal volume of acidified barium nitrate solution.	[1]
3	**(a)** To a small portion of **Z**, add sodium hydroxide solution drop by drop until a change is seen. **(b)** To the same portion, add an excess of sodium hydroxide solution.	[1] [1]
4	**(a)** To a small portion of **Z**, add ammonium hydroxide solution drop by drop until a change is seen. **(b)** To the same portion, add excess ammonium hydroxide solution.	[1] [1]

Conclusion

1 State the formulae of

(a) Cation in **Z** ..... [1]

(b) Anions in **Z**

(i) ..... [1]

(ii) ..... [1]

2 Write down the chemical formula for one of the salts in **Z.**

..... [1]

[Total:10 marks]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test 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.

Test for aqueous cations (in solutions)

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. or very slight white ppt
copper(II) (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

Test for gases

gas	*test and test 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) green

DATA SHEET

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	104 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 Mecury 80	204 Tl Thallium 81	207 Pb lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 +															

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

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

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

$N_A = 6.0 \times 10^{23}$/mol; 1F = 96500C.