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		

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.

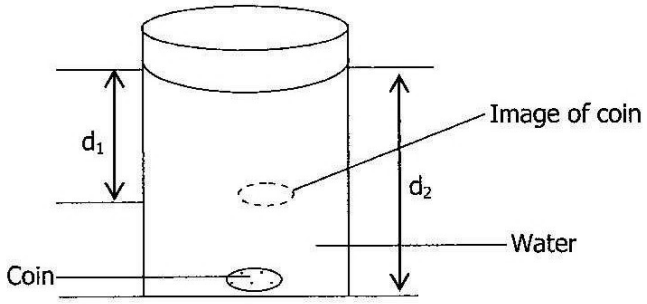


Figure 1.1

(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.

.....

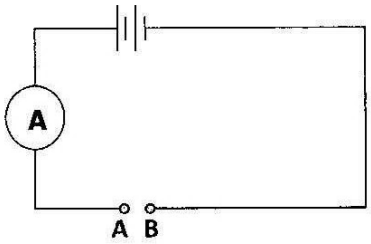
.....

.....

..... [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.

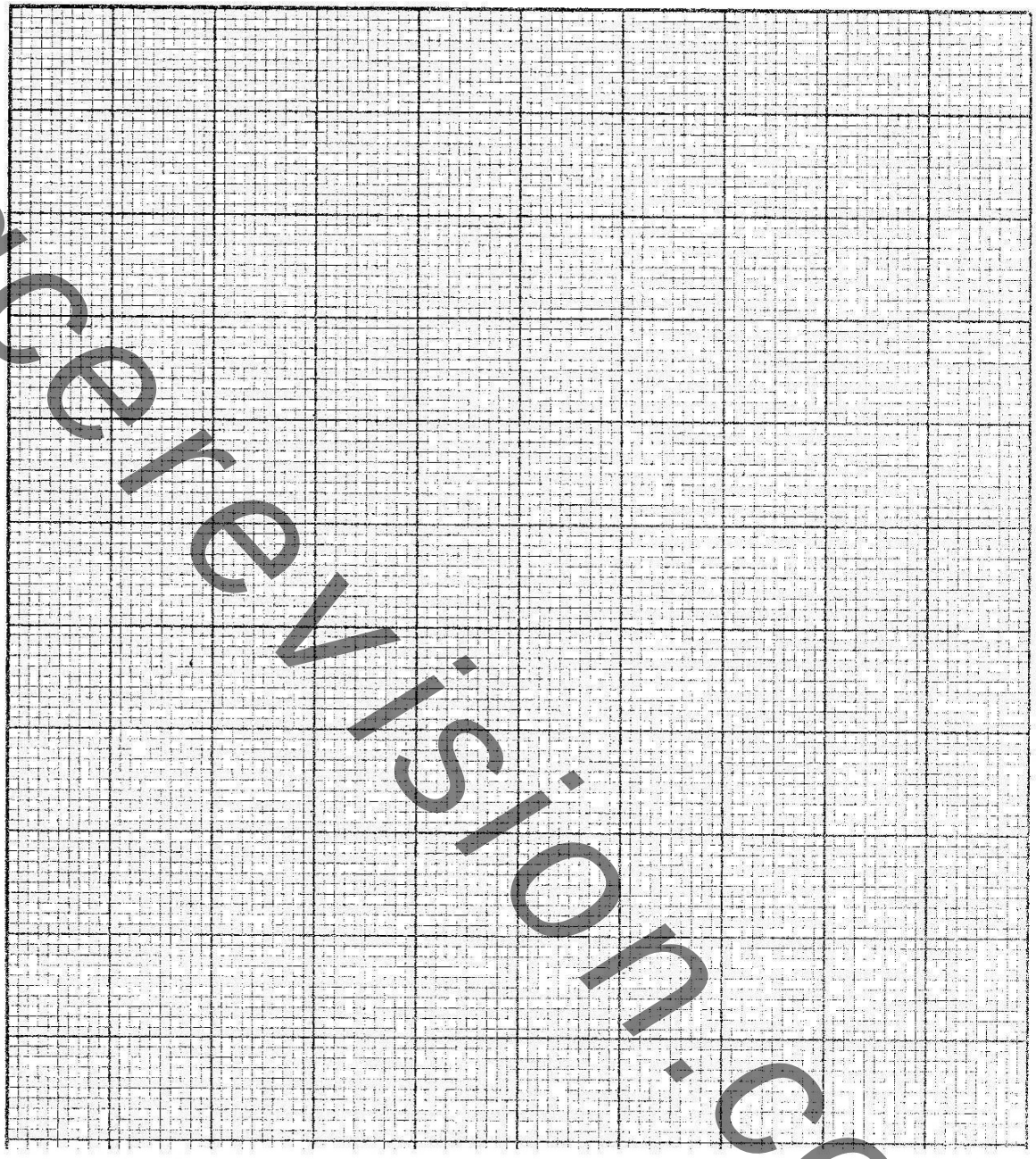
Table 3

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	II											III	IV	V	VI	VII	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** Tchnetium 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 +															

*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** Gadoliniu m 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Yitterbium 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** Lawrenciu m 103

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.