NAME: ..... INDEX NUMBER: .....

SCHOOL: ..... SIGNATURE: .....

P525/1
CHEMISTRY
PAPER 1
JULY/AUGUST 2023
2 HOURS

ASSOCIATION OF SECONDARY SCHOOLS HEADTEACHERS OF UGANDA

(ASSHU) NTUNGAMO

NTUNGAMO DISTRICT JOINT MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

CHEMISTRY
PAPER 1
2 HOURS 45 MINUTES

INSTRUCTIONS TO CANDIDATES

- *Answer **all** question in section A and **six** questions in section **B***
- *All questions **must** be answered in the spaces provided.*
- *The periodic table, with relative atomic masses is attached at the end of the paper.*
- *Mathematical tables (3-figure tables) are adequate or non – programmable scientific electronic calculators may be used.*
- *Illustrate your answers with equations where applicable.*
- *Where necessary, use the following:*
  Molar gas constant, $R = 8.31\ JK^{-1}mol^{-1}$
  Molar volume of gas at s.t.p is 22.4 litres
  Standard temperature = 273K
  Standard pressure = $101325Nm^{-2}$
  Faraday's constant, F = 96500 coulombs

For examiners' use only																	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*Total*

SECTION A (46 MARKS)

*Answer **all** questions in this section*

1. (a) Write balanced equations for the following nuclear reactions (1mk)

(i) loss of a beta particle by palladium – 233

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(ii) The decay of Zinc – 65 to give copper – 65 (1mk)

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(iii) Bombardment of cadmium – 113 with a neutron to give another nucleus and alpha particle (1mk)

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(b) The activity of thorium – 234 was reduced by 25% in 5 days. Determine the half – life of the isotopes (2mks)

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2. Benzene reacts with chlorine under two different conditions to give different products.
State the **two** conditions and write equation for the reaction between benzene and chlorine under each condition (4mks)

Condition

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Equation;

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Condition;

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Equation;

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3. (a) Write equation for the reaction between water and
(i) aluminum chloride (1½mks)

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(ii) Phosphorous (III) chloride (1½mks)

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(b) A piece of clean magnesium ribbon was added to a solution in (a) (i).
State what was observed and write equation for the reaction that took place (2½mks)

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4. The standard electrode potentials of some half –cells are shown below.

Half – cell	$E^{\theta}/Volts$
$Cu^{2+}(aq)/Cu(s)$	+ 0.34
$Zn^{2+}(aq)/zn(s)$	- 0.76
$Na^{+}(aq)/Na(s)$	- 2.71
$Ag^{+}(aq)/Ag(s)$	+ 0.80

(a) Arrange the electrodes in order of reducing power starting with the least reducing (1mk)

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(b) (i) Which two electrodes will form a cell of maximum e.m.f? (1mk)

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(ii) Write the cell notation for the cell you have given in (b) (i) (1mk)

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(iii) Calculate the maximum energy that can be obtained from the cell under standard conditions.
(2½mks)

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5. Complete the following equations and write the IUPAC name of the main organic product in each case

(a) $CH_3CH_2CO_2H + PCl_5 \xrightarrow{\text{Heat}}$ ..... (1½mks)

Name of the product .....

(b) $HC \equiv CH \xrightarrow{Cu(NH_3)_2^+(aq)}$ ..... (1½mks)

Name of the product .....

(c) $CH_3C(CH_3) = CHCH_3 + Br_2 \xrightarrow{H_2O\ (l)}$ ..... (1½mks)

Name of the product .....

6. (a) Write;

(i) the equation for the hydrolysis of potassium propanoate in water (1½mks)

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(ii) an expression for the hydrolysis constant, Kh of potassium propanoate (1mk)

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(b) The ph of a 0.05M aqueous solution of potassium propanoate is 8.3. Calculate the hydrolysis constant, Kn of potassium propanoate. ($Kw = 1.0 \times 10^{-14} mol^2 dm^{-6}$) (3½mks)

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7. (a) Compare the following properties of group I and group II elements. In each case, give reasons for your answer.

(i) Second ionization energy (1½mks)

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(ii) Melting point (2mks)

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(b) Lithium is in group I and magnesium is in group II of the periodic table but the two elements show similar chemical properties.

Give four examples of properties in which the two elements show similarities (2mks)

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8. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case, state what would be observed if each member of the pair was treated with the reagent you have named.

(a) $Na_2S_2O_3(aq) and\ Na_2SO_3(aq)$ (3mks)

Reagent .....

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Observation .....

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(b) CH_3CH_2OH *and* CH_3OH (3mks)

Reagent .....

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Observation .....

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9. 1.24g of a dicarboxylic aliphatic acid was dissolved in water and the solution made up to 250cm^3. 25cm^3 portion of the solution required 21.00cm^3 of 0.1M sodium hydroxide solution for complete neutralization.

(i) Calculate the molecular mass of the acid (3mks)

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(ii) Write the structural formula of the acid (1mk)

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SECTION B (54 MARKS)

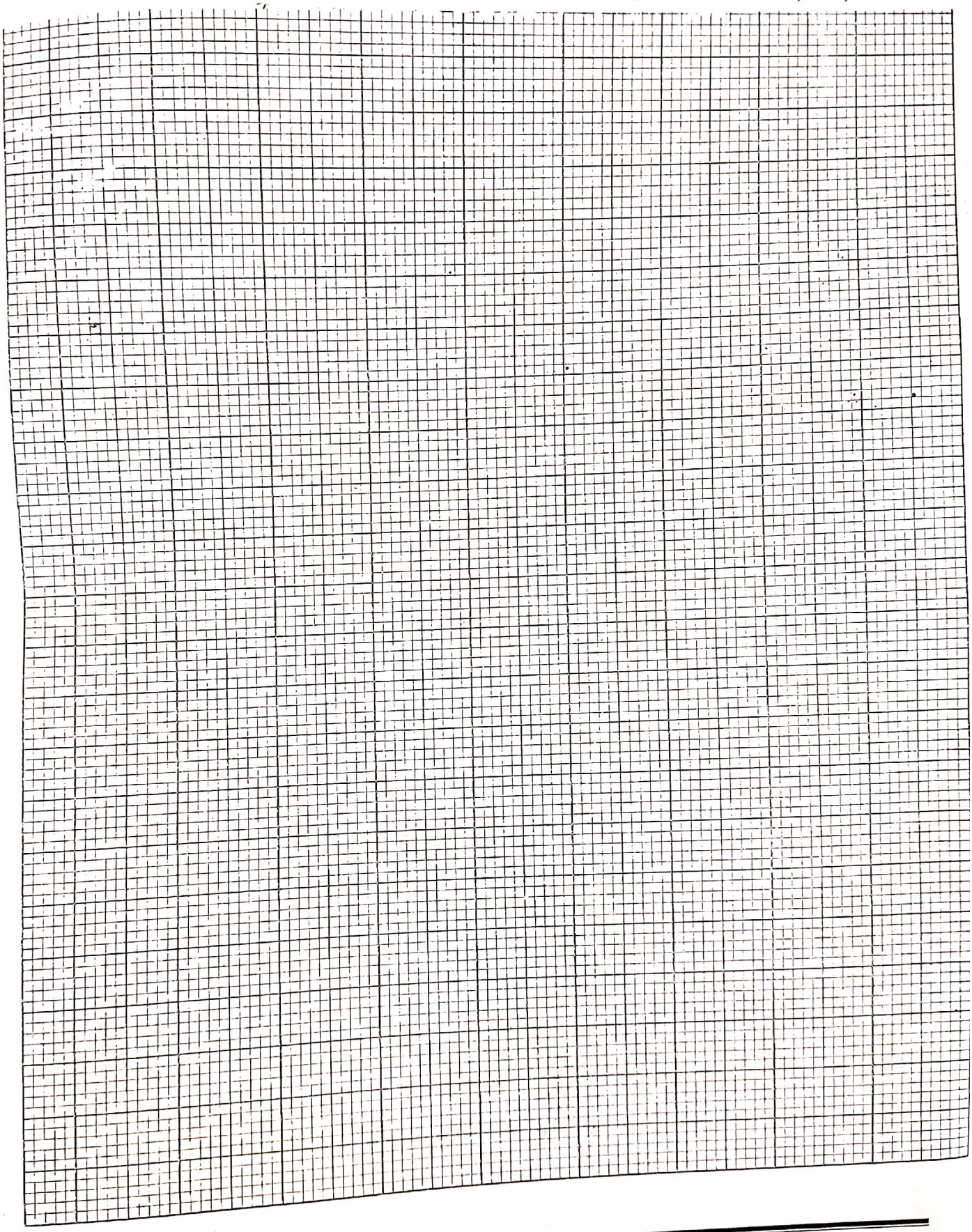
*Answer **six** questions from this section*

Any additional question(s) answered will not be marked

10. The following data shows the variation of solubility of lead(II) chloride with temperature.

Temperature (^{0}C)	10	20	30	45	60	75	80
Solubility in g/100cm^3 of water	1.44	1.49	1.55	1.69	1.90	2.19	2.35

(a) (i) Plot a graph of solubility of lead(II) chloride against temperature (3mks)



(iii) Calculate the solubility product, Ksp of lead (II) chloride at 35^0C. (3½mk)

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(a) Concentrated hydrochloric acid was added to a saturated solution of lead (II) chloride.

(i) State how the solubility of lead (II) chloride was affected (½mk)

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(ii) Explain your answer in (b) (i) above (2mks)

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11. Write equations to show how the following compounds can be synthesized. In each case, indicate the reagents and conditions for the reactions.

(a) $HOCH_2CH_2OH$ from bromoethane (2½mks)

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(b) CH_3CH_2COOH from ethene (3mks)

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(c) $C_6H_5NH_2$ from ethyne

(3½mks)

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12. (a) Write the electronic configuration of iron (1mk)

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(b) Write the formula of the;

(i) hexacyano ferrate (II) ions (½mk)

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(ii) Hexacyano ferrate (III) ions (½mk)

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(c) Give reason why chloride can interconvert the complexes in (b) and write an equation for the reaction.

(2½mks)

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(d) State the conditions and write equations for the reaction between iron and;

(i) Water

(2½mks)

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(ii) Sulphur

(2mks)

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(e) A solution of iron (III) chloride was added to a phenol in solution. State what was observed

.....(½mk)

13. (a) 1.20g of a compound **Q** , containing carbon, hydrogen and oxygen gave on combustion 1.173g of carbon dioxide and 0.240g of water. Determine the empirical formula of **Q** (3mks)

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(b) 1.125g of **Q** in 125g of water gave a solution freezing at -0.186^0C. Calculate the relative molecular mass and write the formula of **Q** (Kf = 1.86^0C per 1000g of water) (3½mks)

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(c) Acidified solution of Manganate (VII) ions was heated with an aqueous solution of **Q**.

(i) State what was observed (1mk)

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(ii) Write equation for the reaction that took place (1½mks)

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14. In the extraction of zinc from zinc blende, the ore is first concentrated and then roasted in air. The roasted material is then mixed with silica and heated by hot air in a blast furnace producing zinc.

(a) Describe the process by which the ore can be concentrated (3mks)

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(b) Write equation(s) for the reactions;

(i) that take place when the ore is roasted in air (1½mks)

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(ii) that led to the formation of zinc in the blast furnance (1½mks)

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(c) Zinc powder was added to hot aqueous sodium hydroxide

(i) State what was observed (1½mks)

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(ii) Write equation for the reaction that took place (1½mks)

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15. An organic compound **X** has molecular formula C_5H_8O. **X** is found to decolourise bromine water and gives a silver mirror when treated with ammoniacal silver nitrate solution.
When **X** is suitably treated with ozone and then hydrolysed, propanone is formed as one of the products.

(a) Identify the functional groups present in **X** (1mk)

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(b) Write the structure of **X** (1mk)

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(c) Write equation and outline a mechanism for the reaction between **X** and;

(i) Hydrogen bromide (3mks)

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(ii) Hydroxylamine, NH_2OH in acidic medium (4mks)

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16. (a) Distinguish between order of reaction and molecularity of a reaction (2mks)

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(b) The table below shows data obtained for the reaction;

$BrO_3^-(aq) + 5Br^-(aq) + 6H^+(aq) \longrightarrow 3Br_2(aq) + 3H_2O(l)$

Experiment	Initial concentration (moldm $^{-3}$)			initial rate (moldm $^{-3}$S $^{-1}$)
	BrO_3^-	Br^-	H^+	
1	0.10	0.10	0.10	1.2 x 10 $^{-3}$
2	0.10	0.30	0.10	3.6 x 10 $^{-3}$
3	0.20	0.10	0.20	9.6 x 10 $^{-3}$
4	0.10	0.10	0.20	4.8 x 10 $^{-3}$

Determine the order of reaction with respect to;

(i) BrO_3^-

(1mk)

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(ii) Br^-

(1mk)

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(iii) H^+

(1mk)

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(c) Write the rate equation for the reaction

(1mk)

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(d) Calculate the rate constant and give its units (1½mks)

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(e) What would happen to the overall order of reaction if the acid was used as a catalyst? Give a reason for your answer (1½mks)

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7. Explain each of the following observations.

(a) The acidity of the hydrides of elements of group VII increases down the group. (3½mks)

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(b) Aldehydes are generally more reactive than ketones towards nucleophilic addition reactions. (2mks)

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(c) The potassium ion and a chloride ion both have same electronic configuration but the potassium ion is much smaller than the chloride ion. (3½mks)

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END