NAME:……Centre/Index No……./……...

Signature:……

P525/1
CHEMISTRY
PAPER 1
2 HOURS 45 Minutes.

MATIGO MOCK EXAMINATION 2022
UGANGA ADVANCED CERTIFICATE OF EDUCATION
CHEMISTRY
Paper 1
2 Hours 45 Minutes

INSTRUCTIONS TO CANDIDATES

- *Answer **All** Questions 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 supplied at the end of the paper.*
- *Mathematical tables (3- figure tables) are adequate or non-programmable scientific electronic calculators may be used.*
- *Illustrate your answer with equations where applicable.*

FOR EXAMINER'S 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. An element **Z** has atomic number 29.

   (a) (i) Write the electronic configuration of **Z**.

   (1 Mark)

   (ii) State the block of the periodic table in which **Z** is found and give a reason for your answer.

   (1 Mark)

   (iii) State whether **Z** is a transition element or non-transition element and why.

   (1 Mark)

   (b) State what is observed and write equations for the reactions taking place when aqueous ammonia is added drop-wise until in excess to a solution of Chromium (III) sulphate.

   (2½ Marks)

2. (a) (i) Write the equation for the hydrolysis of sodium ethanoate in aqueous solution.

   (1Mark)

   (ii) Write an expression for the hydrolysis constant, K_h, of sodium ethanoate.

   (1 Mark)

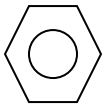
(b) The pH of a 0.1M aqueous sodium ethanoate solution is 8.9. Calculate the hydrolysis constant of the solution.($K_w = 1x10^{-14}$ mol^2 dm^{-6}).

(3 Marks)

3. Complete the following equations and in each case outline a mechanism for the reaction.

(a) $CH_3COCH_3 + H_2NOH \xrightarrow{H^+}$

3 Marks

(b)  + $CH_3COBr \xrightarrow{FeCl_3}$

3 Marks

4. State the properties of the following compounds in which boron resembles silicon, but differs from aluminium. (5 Marks)

Compound	Boron-Silicon	Aluminium
Oxides		
Hydrides		

5. 16 cm^3 of 0.1M hydrochloric acid completely neutralized ammonia in 25 cm^3 of the aqueous layer, if 5.5 cm^3 of 0.01M hydrochloric acid was required to neutralize 25 cm^3 of the ether layer, calculate,

(a) The distribution coefficient of ammonia between water and ether at 25 ^0C.

(3 Marks)

(b) The mass of ammonia extracted by shaking 1000 cm^3 of aqueous solution containing 50g of ammonia with 500 cm^3 of ether at 25 ^0C.

(2 Marks)

6. (a) (i) Give the names and formulae of any ores of Zinc.

(2 marks)

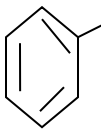
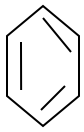
(ii) Describe briefly how one of the ores can be used in the extraction is concentrated.

(3 marks)

(b) State what is observed when a solution of Zinc is added to a few drops of ammonium chloride solution followed by a few drops of disodium hydrogen phosphate solution, then ammonia solution drop-wise until in excess.

(1 mark)

7. Show how the following conversions could be carried out.

(a)  CH_2OH to 

(2½ Marks)

(b) $CH_3CH_2CH = CH_2$ from ethyne.

(3 Marks)

8. (a) Polonium, ${}^{216}_{84}Po$ undergoes radioactive decay to give elements X an Y according to the following equation:
${}^{216}_{84}Po \longrightarrow X + \beta \longrightarrow Y + \alpha.$

Write the:

(i) atomic numbers of X an Y.

(1 Mark)

(ii) mass numbrs of X an Y.

(1 Mark)

(b) Calculate the half life of Y. (The decay constant of Y is $6.54X10^{-4}\ \text{min}^{-1}$).

(2 Marks)

9. Compound **P** is a blue-green solid. **P** dissolved in water to give a pale blue solution. The solution of **P** formed a brown precipitate when reacted with potassium hexacyanoferrate (II) solution and a reddish-brown solution when a few drops of iron (III) chloride solution were added to it. When **P** was heated with concentrated sulphuric acid, ethanoic acid was formed.

(a) Identify **P**.

(1 Mark)

(b) Write the equation for the reaction that took place when **P** was heated with concentrated sulphuric acid.

(1½ Marks)

(c) Write the equation(s) for the reaction(s) that would take place when excess ammonia solution is added to a solution of **P**.

(1½ Marks)

SECTION B (54 MARKS)

Answer ANY six questions in this section

10. A hydrocarbon **W** contains 88.8% by mass of carbon. Its relative formula mass is 54.

(a) Calculate the molecular formula of **W**.

(4 Marks)

(b) Write down all the possible isomers of **W** and name each of them according to the IUPAC system.

(2 Marks)

(c) One of the isomers of **W** gives positive results with Tollen's reagent. Write down the isomer which gives positive results with Tollen's reagent and explain what is observed.

(3 Marks)

11 (a) 25 cm^3 of a solution containing a mixture of sodium carbonate and sodium hydrogen carbonate required 15 cm^3 of 0.5 M hydrochloric acid for complete reaction using phenolphthalein indicator. 25 cm^3 of the solution of the mixture required 34.5 cm^3 of the acid using methyl orange indicator. Calculate the mass of sodium carbonate and sodium hydrogen carbonate in the solution in grams per litre.

6 Marks

(b) Concentrated nitric acid is 70%(w/w) and has a density of 1.42g cm^{-3}. Calculate the molarity of the concentrated nitric acid.

3 Marks

12. (a) Define '**electrolytic conductivity'** (1 Mark)

(b) The molar ionic conductivity at infinite dilution of some ionic species are shown below:

Ion	$\lambda^o (\Omega^{-1} cm^2 mol^{-1})$
Na^+	50.1
OH^-	198.6
H^+	349.8
Cl^-	76.4

Calculate the electrolytic conductivities for:

(i) 0.01M sodium hydroxide solution.

(2 Marks)

(ii) a solution made by mixing 50 cm^3 of 0.01M sodium hydroxide and 50 cm^3 of 0.02M hydrochloric acid.

(5 Marks)

(c) state **two** uses of conductivity measurements.

(1 Mark)

13. (a) State:
(i) the Distribution law.

(3½ Marks)

(ii) the conditions under which the Distribution law is valid.

(1½ Marks)

(b) 100 cm^3 of an aqueous solution containing 10 g of a compound **Q** was shaken with 100 cm^3 of benzene. **Q** is more soluble in benzene and the partition coefficient of **Q** between benzene and water is 12.2.
Calculate the mass of **Q** left in the aqueous layer.

(3 Marks)

(c) State **one** application of partition of solutes.

(1 Mark)

14. (a) Iron (II) sulphate is normally used to standardize a solution of potassium manganate (VII) acidified using sulphuric acid.

(i) Write the equation for the reaction between potassium manganate (VII) and iron (II) sulphate.

(1½ Marks)

(ii) State why hydrochloric acid is not used to acidify potassium manganate (VII) solution.

(1½ Marks)

(b) 25 cm^3 of an acidified solution of 0.02M potassium manganate (VII) reacted exactly with 25 cm^3 of sodium nitrite. Potassium manganate (VII) reacts with sodium nitrite according to the following equation.

$2MnO_4^-(aq) + 5NO_2^-(aq) + 6H^+(aq) \longrightarrow 2Mn^{2+}(aq) + 5NO_3^-(aq) + 3H_2O(l)$

Calculate the concentration of the sodium nitrite in moles per litre.

(4 Marks)

15. (a) Define the term a **buffer solution.** (2 Marks)

(b) Calculate the mass of sodium ethanoate that should be added to 1 litre of a 0.1M ethanoic acid solution in order to produce a solution of pH = 4.0 (K_a for ethanoic acid = 1.8×10^{-5}). (5 Marks)

(c) State what would happen to the ph of the solution in (b), if a small amount of the following were added

(i) sodium hydroxide solution. (½ Mark)

(ii) hydrochloric acid. (½ Mark)

(d) State **one** biological application of a buffer solution (1 Mark)

16. Explain the following observations.

(a) Although Zinc belongs to the d-block of the periodic Table, is not a true transition metal. (3 Marks)

(b) When silver nitrate solution is added to $CrCl_3.6H_2O$, one mole of this compound produces 2 moles of silver chloride as white precipitate instead of 3 moles. (3 Marks)

(c) The most stable oxidation states of manganese and iron are +2 and +3 respectively. (3 Marks)

17. State the reagents that can be used to distinguish between each of the following pairs of chemical species. State what would be observed in each case.

(a) $(CH_3)_3COH$ *and* $(CH_3)_3CCH_2OH$.

……
……
……
……
……
……
……(3 Marks)

(b) CH_3COH *and* CH_3COCH_3.

……
……
……
……
……
……
……(3 Marks)

(c) CH_3CH_2COOH *and* $HCOOH$.

……
……
……
……
……
……(3 Marks)

THE PERIODIC TABLE

1	2											3	4	5	6	7	8
$^{1.0}_{1}H$																$^{1.0}_{1}H$	$^{4.0}_{2}He$
$^{6.9}_{3}Li$	$^{9.0}_{4}Be$	TRANSITION ELEMENTS										$^{10.8}_{5}B$	$^{12}_{6}C$	$^{14}_{7}N$	$^{16}_{8}O$	$^{19}_{9}F$	$^{20.2}_{10}Ne$
$^{23.0}_{11}Na$	$^{24}_{12}Mg$											$^{27.0}_{13}Al$	$^{28.1}_{14}Si$	$^{31.0}_{15}P$	$^{32.1}_{16}S$	$^{35.5}_{17}Cl$	$^{40}_{18}Ar$
$^{39.1}_{19}K$	$^{40.1}_{20}Ca$	$^{45.0}_{21}Sc$	$^{47.9}_{22}Ti$	$^{50.9}_{23}V$	$^{52.0}_{24}Cr$	$^{54.9}_{25}Mn$	$^{55.8}_{26}Fe$	$^{58.9}_{27}Co$	$^{58.7}_{28}Ni$	$^{63.5}_{29}Cu$	$^{65.7}_{30}Zn$	$^{69.7}_{31}Ga$	$^{72.6}_{32}Ge$	$^{74.9}_{33}As$	$^{79.0}_{34}Se$	$^{79.9}_{35}Br$	$^{83.8}_{36}Kr$
$^{85.5}_{37}Rb$	$^{87.6}_{38}Sr$	$^{88.9}_{39}Y$	$^{91.2}_{40}Zr$	$^{92.9}_{41}Nb$	$^{95.9}_{42}Mo$	$^{98.9}_{43}Tc$	$^{101}_{44}Ru$	$^{103}_{45}Rh$	$^{106}_{46}Pd$	$^{108}_{47}Ag$	$^{112}_{48}Cd$	$^{115}_{49}In$	$^{119}_{50}Sn$	$^{122}_{51}Sb$	$^{128}_{52}Te$	$^{127}_{53}I$	$^{131}_{54}Xe$
$^{133}_{55}Cs$	$^{137}_{56}Ba$	$^{139}_{57}La$	$^{178}_{72}Hf$	$^{181}_{73}Ta$	$^{184}_{74}W$	$^{186}_{75}$Re	$^{190}_{76}Os$	$^{192}_{77}Ir$	$^{195}_{78}Pt$	$^{197}_{79}Au$	$^{201}_{80}Hg$	$^{204}_{81}Tl$	$^{207}_{82}Pb$	$^{209}_{83}Bi$	$^{209}_{84}Po$	$^{210}_{85}At$	$^{222}_{86}Rn$
$^{223}_{87}Fr$	$^{226}_{88}Ra$	$^{227}_{89}Ac$															
			$^{139}_{57}La$	$^{140}_{58}Ce$	$^{141}_{59}$Pr	$^{144}_{60}Nd$	$^{145}_{61}Pm$	$^{150}_{62}Sm$	$^{152}_{63}Eu$	$^{157}_{64}Gd$	$^{159}_{65}Tb$	$^{162}_{66}Dy$	$^{165}_{67}Ho$	$^{167}_{68}Er$	$^{169}_{69}Tm$	$^{173}_{70}Yb$	$^{175}_{71}Lu$
			$^{227}_{89}Ac$	$^{232}_{90}Th$	$^{231}_{91}Pa$	$^{238}_{92}U$	$^{237}_{93}Np$	$^{244}_{94}Pu$	$^{243}_{95}Am$	$^{247}_{96}Cm$	$^{247}_{97}Bk$	$^{251}_{98}Cf$	$^{254}_{99}Es$	$^{257}_{100}Fm$	$^{256}_{101}Mv$	$^{254}_{102}No$	$^{}_{103}Lw$

END