P525/1
CHEMISTRY
PAPER 1
2 ¼

Uganda Advanced Certificate Of Education

CHEMISTRY

PAPER 1

TIME: 2hours 45minutes

Instructions to candidates;

- *Answer **all questions in Section A** and **any six in Section B**.*
- *All questions must be answered in spaces provided.*
- *Illustrate your answers with equations where applicable.*
- *Molar gas constant, R=8.314jk^{-1}mol^{-1}*
- *Molar volume for a gas at s.t.p is 22400cm^3*
- *Standard temperature =273k*
- *Standard pressure =101325 Nm^{-2}*

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) i) The decay law is given by the expression; $-\frac{dN}{dt} = \lambda N$. State what is the following symbols represent. (1½ marks)

$\frac{dN}{dt}$ .....

λ .....

N .....

ii) Using the decay equation $In\left(\frac{No}{Nt}\right) = \lambda t$; derive the expression for the half life, $t\frac{1}{2}$ for a radioactive substance. (1 ½ marks)

.....

.....

.....

.....

b) Nickel $(^{63}_{28}Ni)$ decays to copper $(^{63}_{29}Cu)$. Name the particle emitted and write the equation for the reaction.

Name of particle (2marks)

.....

Equation

.....

.....

2) 20cm^3 of a gaseous hydrocarbon X was exploded with 100cm^3 of oxygen. After the explosion, the volume of the residue gas was found to be 90cm^3. On addition of concentrated potassium hydroxide, the volume decreased to 50cm^3.

a) Determine the molecular formula of X. (2marks)

.....

.....

.....

.....

.....

.....

b) X reacts with Ammoniacal copper (I) chloride solution.
i) State what is observed. (1mark)

.....

.....

ii) Write equation for the reaction that takes place. (1marks)

.....

.....

c) Write equation for incomplete combustion of X. (1mark)

.....

.....

3. a) State three properties in which Beryllium resembles Aluminum. (3marks)

.....

.....

.....

.....

b) i) What is the name given to the relationship in (a)? (1mark)

.....

ii) Name another pair of elements that show the type of relationship in (a).
(1mark)

.....

4. The following experiment results were obtained for the reaction
A+ 2B $\longrightarrow$ products.

Exp't no.	Initial concentrations $(moll)^{-1}$		Initial rate $(mol l^{-1}s^{-1})$
	A	B	
1	3.0×10^{-2}	3.0×10^{-2}	2.7×10^{-5}
2	3.0×10^{-2}	6.0×10^{-2}	5.4×10^{-5}
3	6.0×10^{-2}	3.0×10^{-2}	10.8×10^{-5}

a) i) deduce the order of reaction with respect to

A .....

.....

.....

.....

B .....

.....

.....

.....

ii) Write the expression for the rate equation. (½ mark)

.....

b) Calculate the value of rate constant, K, using the expression in a(ii) above and state its units. (1 ½ marks)

.....

.....

.....

.....

c) State how the rate value will be affected if the concentration of A is doubled and the concentration of B is halved. (1mark)

.....

5. a) 50cm^3 of a vapourised alcohol Q, C_nH_{2n+1} OH diffused through a small hole in 119.85 seconds. Under the same conditions, the same volume of hydrogen diffused through the hole in 21.85 seconds.

i) Calculate the molecular formula of Q (2 ½ marks)

.....

.....

.....

.....

.....

.....

b) Write down the structural formulae and I.U.P.A.C names of all the possible isomers of Q. (2marks)

.....

.....

.....

c) Q reacts with aqueous sodium hydroxide and iodine solution to give a yellow precipitate. Identify Q. (½ mark)

.....

.....

6. a) Define the term transition elements. (1 ½ marks)

.....

.....

.....

b) State any three (3) characteristic properties of transition elements. (1½ marks)

.....

.....

.....

.....

c) What is meant by the term oxidation state? (1mark)

.....

.....

.....

d) Explain why transition metals form compounds with variable oxidation state. (2marks)

.....

.....

.....

.....

8. Write equation for the reaction between

i) Silcon (IV) oxide and hydrolouric acid. (1 ½ marks)

.....

.....

ii) tin and concentrated Sulphuric acid. (1 ½ marks)

.....

.....

iii) Trilead tetra oxide and nitric acid. (2marks)

.....

.....

.....

9. a) Benzene reacts with iodomethane in presence of a catalyst to form methylabenzene.

i) Name the catalyst used (½ marks)

.....

.....

ii) Outline a mechanism for the reaction. (2marks)

.....

.....

.....

.....

.....

.....

b) Write equations to show how methylbenzene can be converted to benzene.

(2 ½ marks)

.....

.....

.....

.....

.....

SECTION B (54MARKS)

*Attempt any **six** questions.*

10. Flourine shows differences in its properties from the rest of group (VII) elements.

i) State three properties in which fluorine is different from other group(VII) elements. (3marks)

.....

.....

.....

.....

.....

ii) State any 3 reasons why fluorine reacts differently from the others. (3marks)

.....

.....

.....

.....

.....

b) HF, HCl, HBr and HI are hydrides of group(VII) elements. State and explain the trend in boiling points of the hydrides. (3marks)

.....

.....

.....

.....

.....

.....

11. a) i) Define the term solubility product . (1mark)

.....

.....

ii) State any two factors that affect solubility of a sparingly soluble salt. (1mark)

.....

.....

b) Calcium hydroxide is sparingly soluble in water; write the

i) equation for solubility of calcium hydroxide

.....

.....

ii) expression for the solubility produce of calcium hydroxide. (½ mark)

.....

.....

c) 10g of calcium hydroxide was shaken with a 0.05moldm^3 aqueous solution of sodium hydroxide. Calculate the percentage of calcium hydroxide that dissolved. State any assumptions made. (Solubility product constant Ksp for calcium hydroxide is 5.5×10^{-6} mol^{3}dm^{-9}) (4marks)

.....

.....

.....

.....

.....

.....

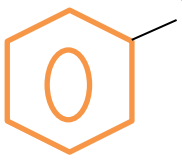
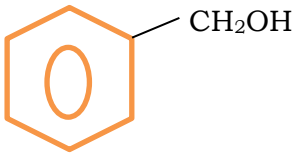
d) State any **two** applications of solubility product. (1mark)

.....

.....

.....

12. Name the 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 is separately treated with the reagent. (3marks each)

a)  and 

Name of reagent(s)

.....

.....

.....

Observation

.....

.....

.....

.....

b) $(CH_3)_3COH$ and $CH_3\underset{\underset{OH}{|}}{C}H\ CH_3$

Name of reagent(s)

.....

.....

.....

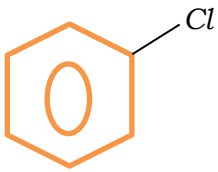
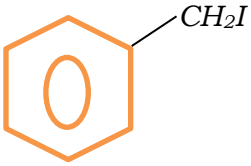
Observation

.....

.....

.....

.....

c)  and 

Name of reagent(s)

.....

.....

.....

Observation

.....

.....

.....

.....

13. a) Complete the table below. (3marks)

Element	Na	Mg	Al	Si	P	S	Cl
Formula of hydride							

b) Describe the reactions of the hydrides of
i) Sodium

.....

.....

.....

ii) Chloride with water (4marks)

.....

.....

.....

c) Explain why the melting point of aluminium bromide is 97.5^0C where as that of aluminium fluoride is 192^0C. (2marks)

.....

.....

.....

.....

.....

.....

14. Write equation, to show how the following conversions can be effected. (3marks each)

a) Ethanol to Benzene

.....

.....

.....

.....

.....

b) Ethanoic acid from propan -1- ol

.....

.....

.....

.....

.....

c) Phenol from benzene using Propene

.....

.....

.....

.....

.....

15. In an experiment that was carried out to determine the volume strength of hydrogen peroxide solution;
* 5cm^3 of concentrated hydrogen peroxide was diluted to make 250cm^3 of solution. 25.0cm^3 of the diluted solution reacted with 25.00cm^3 of 0.2M potassiumiodide solution in presence of 10.0cm^3 of 2M Sulphuric acid.
* The resultant mixture was then titrated with 14.50cm^3 of 0.1M sodium thiosulphate solution.

a) Write the ionic equation of reaction between hydrogen peroxide solution and potassium iodide solution. (1½ marks)

.....

.....

b) Calculate the number of moles of hydrogen peroxide solution in 250cm^3 of solution. (4 ½ marks)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

c) Deduce the volume strength of the original hydrogen peroxide solution. (1mole of hydrogen peroxide solution liberates 11.2dm^3 of oxygen gas) (3marks)

.....

.....

.....

.....

.....

16. a) 50cm^3 of an Ammine Q, $C_n H_{2n+1}NH_2$, diffuses through a small hole in 126seconds. Under the same volume of hydrogen diffuses through the hole in 26.57seconds.

i) Calculate the molecular mass of Q. (2 ½ marks)

.....

.....

.....

.....

.....

.....

ii) Determine the molecular formula of Q. (2marks)

.....

.....

.....

.....

.....

b) Write the structural formulae and IUPAC names of all the possible isomers of Q. (3marks)

.....

.....

.....

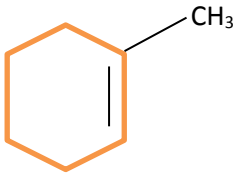
.....

.....

c) Write an equation of reaction between an aqueous solution of Q and dilute hydrochloric acid. (1 ½ marks)

.....

17. Complete the following equations and write the mechanism(s) for the reaction(s)

a)  $\xrightarrow{HCl}$ (3marks)

.....

.....

.....

.....

.....

.....

b) $CH_3C \equiv CH \xrightarrow[H_2SO_4(aq)\ ,\ HgSO_4(aq)]{H_2O}$ (3marks)

heat 60^0C

.....

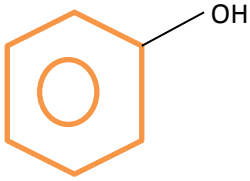
.....

.....

.....

.....

.....

c)  + $CH_3CH_2Br \xrightarrow{NaOH(aq)}$ (3marks)

.....

.....

.....

.....

.....

.....

END