NAME ; …………………………………………………………..

P525/1
CHEMISTRY
Paper 1
2³/₄ hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION
SENIOR SIX MOCK EXAMINATIONS
SENIOR SIX CHEMISTRY
PAPER 1
2hours 45 minutes

INSTRUCTIONS

Answer **all** questions in section **A** and **six** questions in section **B.**

Any **extra** question answered will not be marked.

All questions must be answered in the spaces provided

The Periodic Table with relative atomic masses will be provided

Illustrate your answers with equations where applicable

Molar gas constant R = 8.314 $Jmol^{-1}K^{-1}$

Molar volume of gas at s.t.p is 22.4 litres

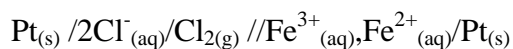For Examiners Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

SECTION A (46 MARKS)

(Answer all the questions)

(1) A cell convention is written as;

$$Pt_{(s)} /2Cl^-_{(aq)}/Cl_{2(g)} //Fe^{3+}_{(aq)},Fe^{2+}_{(aq)}/Pt_{(s)}$$

Given the following standard electrode potential values

E^0/V

$Cl_{2(g)}/2Cl^-_{(aq)}$ +1.36

$Fe^{3+}_{(aq)},Fe^{2+}_{(aq)}$ +0.76

(a) Calculate the e.m.f for the cell written in the cell convention above.

(2 marks)

(b) State whether the reaction is feasible or not. Give a reason for your answer.

($1^1/_2$ marks)

(b) Write overall equation for the **feasible** reaction.

($1^1/_2$ marks)

(2) An organic compound Q contains by mass 76.60% carbon, 6.38% hydrogen and the rest oxygen. Compound Q has a vapour density of 47 and burns with a sooty flame.
(a) Determine the;
(i) Empirical formula of Q.

(2 marks)

(ii) Molecular formula of Q

(b) State what will be observed and write equation for the reaction that takes place when compound Q is reacted with;

(i) benzenediazonium chloride in presence of sodium hydroxide solution.

Observation

($\frac{1}{2}$ mark)

Equation

($1\frac{1}{2}$ marks)

(ii) ethanoic acid in presence of sodium hydroxide solution

Observation

($\frac{1}{2}$ mark)

Equation

($1\frac{1}{2}$ marks)

(3) State what will be observed and write equation for the reaction that takes place when aqueous ammonia is added drop wise until in excess to ;

(a) Tin(II) chloride solution

Observation

(1 mark)

Equation

(1mark)

(b) Nickel (II) ethanoate solution.

Observation

($1\frac{1}{2}$ marks)

Equation

($2\frac{1}{2}$ marks)

(4) (a) 2.0g of phosphorous when dissolved in 37.4g of carbon disulphide raised the boiling point of the by 1.003^0C. Boiling point constant for carbon disulphide is 2.35^0C $mol^{-1}kg^{-1}$.

Determine the molecular formula of phosphorous in carbon disulphide.

(4 marks)

(b) Comment on your answer in (b).State the reason.

(2 marks)

(5) State the conditions and write equation for the reaction that takes place for each of the elements given below and water.
(a) Carbon
Condition(s)

(1 mark)

Equation

(1 mark)

(b) Lead
Condition(s)

($^1/_2$ mark)

Equation

($1^1/_2$ marks)

(6) (a) State what will be observed when 2,4-dinitrophenyl hydrazine is added to cyclohexanone in presence of a few drops of concentrated sulphuric acid.

($^1/_2$ mark)

(b) Outline the reaction mechanism for the reaction that takes place in (a) above.

4

(7) For each of the compounds given, state the co-ordination number and oxidation state of the central atom and then give the name.

| Compounds	Co-ordination number	Oxidation state	Name
$[Fe(H_2O)_5(SCN)]^{2+}$			
$Ag(CN)_2^-$			

(4 marks)

(8) 2.0g of an **impure** sample of chromium (III) oxide was reacted with $100cm^3$ of 1.0M of hydrochloric acid which was in excess. The resultant solution formed was diluted to $250cm^3$ with distilled water.20 cm^3 of this solution required $19.40cm^3$ of 0.1M sodium hydroxide solution for complete reaction. Determine the percentage purity of the sample.

(5 marks)

(9) (a) A polymer has the structure
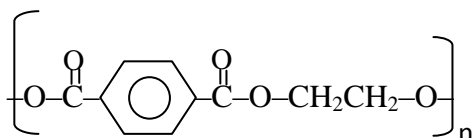
(i) State the type of polymerization involved in formation of the above given polymer.

(1 mark)

(ii) Name the monomers involved in the formation of the polymer.

(1 mark)

(b) Name one other example of an artificial polymer that can be formed by the process as one named in (a) i above and name the monomers involved.

Name of polymer

($^1/_2$ mark)

Name of monomers

(1mark)

SECTION B (54 MARKS)
Answer **six** questions

(10)(a) Explain what is meant by the term enthalpy of neutralization

(1mark)

(b) In an experiment to determine the enthalpy of neutralization ,sulphuric acid was added drop wise to 30cm^3 of 0.4M sodium hydroxide solution. The initial temperatures of sulphuric acid and sodium hydroxide solution were 29^{0}C and 27^{0}C respectively.
The table below shows the results obtained during this experiment.

Volume of sulphuric acid added / cm^3	3.0	7.5	12	16.5	18.0	20	22	25	27.5
Temperature of the solution/ ^{0}C	29.1	30.9	32.5	33.8	34.0	34.0	34.0	33.5	33.1

(i) Tabulate the values for the rise in temperature. (1mark)

(ii) Plot a graph of temperature rise against the volume of sulphuric acid added. (3 marks)

6

(iii) Determine the molarity of sulphuric acid.

(2 marks)

(iv) Calculate the enthalpy of neutralization by sulphuric acid.

(2marks)

(11) The table below shows the hydrides of the group (VII) elements and their boiling points.

Hydrides	HF	HCl	HBr	HI
Boiling points / K	253	188	206	238

(a) Explain the trend in the boiling points of the hydrides.

(b) The hydrides form acid solutions when dissolved in water. Arrange the hydrides of HBr , HCl and HI in order of increasing acid strength. Give reason for your answer.

(3marks)

(c) Write equation to show how hydrogen fluoride and hydrogen bromide can be prepared.

(i) Hydrogen fluoride

(1 mark)

(ii) Hydrogen bromide

(1 mark)

(12) Write equations to show how the following synthesis can be carried out. In each case indicate the reagents and conditions necessary.
(a) Propan-2-ol from 1-Bromopropane

(3 marks)

(b) Propanoic acid to ethylamine

(3 marks)

(c) —COCH$_3$ from benzene

(3 marks)

(13)(a) Draw the structure and name the shapes of the species given in the table below

Species	Structure	Shape
NO$_2^-$		
NO$_3^-$		
NO$_2^+$		

(4^1/$_2$ marks)

(b) Arrange the above given species in order of **increasing bond angle**.

(1^1/$_2$ marks)

(c) Name the reagent that can be used to distinguish between NO$_2^-$ and NO$_3^-$.
State the observation made.
Reagent

(1 mark)

Observation

(2 marks)

(14) (12) (a) State **Hess' Law** of constant heat summation.

($1\frac{1}{2}$ marks)

(b) (i) Explain what is meant by the term standard enthalpy of formation

(1 mark)

(ii) The standard enthalpies of combustions of carbon, hydrogen and propanol are ;
-394 , -286 and -2010 Kj mol^{-1} respectively.
Determine the standard enthalpy of formation of propanol.
(c) The following information is given;
Enthalpy of formation of magnesium oxide   = -642 Kj mol^{-1}
Enthalpy of atomization of magnesium   = +148 Kj mol^{-1}
First ionization energy of magnesium   = + 738 Kj mol^{-1}
Second ionization energy of magnesium   = +1452 Kj mol^{-1}
Bond dissociation energy of oxygen   = +496 Kj mol^{-1}
First electron affinity of oxygen =   = -152 Kj mol^{-1}
Second electron affinity of oxygen =   = +798 Kj mol^{-1}

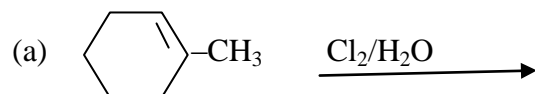(iii) Calculate the lattice energy of magnesium oxide.

(4 marks)

(iv) State whether magnesium oxide is stable or not. Give a reason.

(1$^{1}/_{2}$ marks)

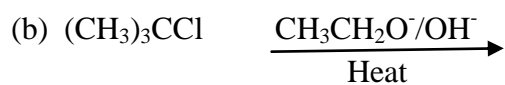(iv) State the **two** factors that affect magnitude of lattice energy.

(1 mark)

(15) Complete the following organic reactions and outline the reaction mechanism.
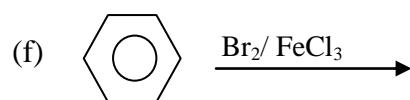
(a) —CH$_3$ $\xrightarrow{Cl_2/H_2O}$

Mechanism

(3 marks)

(b) (CH$_3$)$_3$CCl $\xrightarrow[\text{Heat}]{CH_3CH_2O^-/OH^-}$

Mechanism

(3 marks)

(f) $\xrightarrow{\text{Br}_2/\text{FeCl}_3}$

Mechanism

(3 marks)

(16) (14) (a) The elements beryllium, magnesium and barium belong to group II in the Periodic Table.
(i) Write the general outer electronic configuration of these elements.

($^1/_2$ mark)

(ii) State any **two** similar chemical properties shown by the elements. For each property, write an equation to illustrate your answer.

(4 marks)

(b) Beryllium differs in some of its properties from the rest of the elements in the group
(i) State any **two** properties in which Beryllium differs from the rest of the members of the group.

(2 marks)

(ii) Give reasons why Beryllium shows different properties from the rest of the elements.

($1^1/_2$ marks)

(c) Name one reagent that can be used to distinguish between calcium ions and Barium ions.

(1 mark)

(17)   During extraction of sodium metal, molten sodium chloride is mixed with another compound and the mixture electrolyzed in Downs cell. Both sodium metal and chlorine gas are obtained.
(a) Name the compound which is mixed with sodium chloride before it's electrolyzed and state its role.

($1^1/_2$ marks)

(b) Write equations for the reaction that occur at the ;
Anode

(1 mark)

Cathode

(1mark)

(c) State **one** use of sodium metal

($^1/_2$ mark)

(c) State what will be observed and write equation for the reaction that occurs when ;
(i) A piece of sodium metal is added to ethanol
Observation

(1 mark)

Equation

($1^1/_2$ marks)

(ii) Chlorine gas is bubbled through hot concentrated sodium hydroxide solution.
Observation

(1 mark)

Equation

($1^1/_2$ marks

END