

NAME

P525/1

CHEMISTRY

PAPER 1

2³/₄ Hours

DEPARTMENT OF CHEMISTRY

UGANDA ADVANCED CERTIFICATE OF EDUCATION

SENIOR SIX CHEMISTRY

PAPER I

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 provided.

*Illustrate your answers with **equations** where applicable

* Molar gas constant = $8.314 \text{ J mol}^{-1}\text{K}^{-1}$

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

One atmosphere = 101325 Nm^{-2}

For examiners use only

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
Marks																		

SECTION A (46 marks)

Answer **all** the questions

(1) (a) State Raoult's law of lowering of vapour pressure.

(1 mark)

(b) (i) The vapour pressure of water at 25°C is 3168Nm^{-2} . At the same temperature the vapour pressure of a solution containing 2.74g of compound G in 1000g of water is 3167.54Nm^{-2} . Determine the molecular mass of G.

(3 marks)

(ii) State any **two** assumptions in (b) i above.

(1 mark)

(2) State what will be observed and write equation for the reaction that takes place when;

(a) Hot acidified potassium permanganate solution is added to

methanoic acid.

Observation

(1 mark)

Equation

(1 mark)

(b) Bromine water is added to phenyl amine.

Observation

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

Equation

(1 mark)

(c) 2,4-Dinitrophenylhydrazine is added to cyclohexanone.

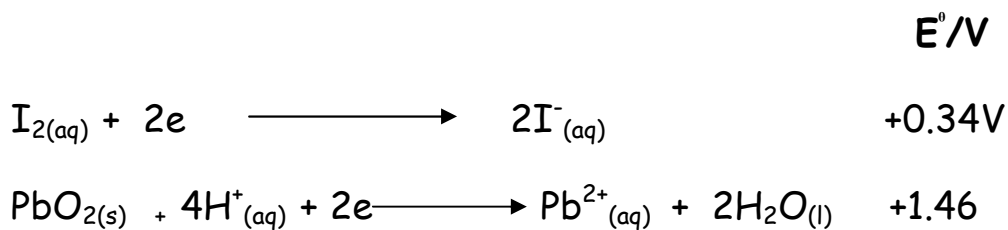
Observation

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

Equation

(1 mark)

(3) The following half cell reactions are given;



(a) Write the cell notation for the cell formed by combining the two half cells.

(2 marks)

(b) State what will be observed at the ;
Anode

(1 mark)

Cathode

(1 mark)

(c) Calculate the e.m.f for the cell

(1¹/₂ marks)

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

(1 mark)

(e) State one application of standard electrode potential.

(¹/₂ mark)

(4) Phenol reacts with ethanoyl chloride in presence of sodium hydroxide and iron (III) chloride respectively to form different products.

(a) Write equations for the reactions of phenol with ethanoyl chloride under the stated conditions.

In presence of;

(i) sodium hydroxide solution.

(1 mark)

(ii) iron (III)chloride

(1 mark)

(b) Outline the reaction mechanism in (a)i.

(2¹/₂ marks)

(5) (a) (i) State how iron(III)chloride can be prepared.

(1 mark)

(ii) Write equation for the reaction

(1 mark)

(iii) State the type of bond and structure in iron (III) chloride.

Type of bond

(¹/₂ mark)

Structure

(¹/₂ mark)

(b) Sodium carbonate solution was added to aqueous solution of iron (III) chloride. State what was observed and write equation for the reaction that takes place.

Observation

(1 mark)

Equation

(1 mark)

(6) (a) Explain what is meant by the term **enthalpy of neutralisation**.

(1 mark)

(b) 50cm^3 of 2M sodium hydroxide solution was added to 100cm^3 of 1M sulphuric acid in a plastic beaker .The temperature of the solution rose to 35°C . The initial temperatures of sodium hydroxide and sulphuric acid solutions were 27°C and 25°C respectively. Calculate the enthalpy of neutralisation of the reaction by sulphuric acid.

(Take the density and specific heat capacity of the solution to be 1.0gcm^{-3} and $4.2\text{J mol}^{-1} \text{K}^{-1}$ respectively).

(4 marks)

(c) State any **two** assumptions made in (b).

(1 mark)

(7) (a) A cyclic hydrocarbon Q contains by mass 12.20% hydrogen and has density of 3.42 g dm^{-3} at room temperature. Determine the empirical formula of Q.

(2 marks)

(b) (i) Determine molecular formula of Q.

(2 marks)

(ii) Write down the structural formula of Q and name the compound.

(1 mark)

(8) Nylon-6,10 is a polymer made by reacting hexane-1,6-diamine together with decanedioyl dichloride.

(a) Write the structural formulae of the monomers of Nylon-6,10.

(2 marks)

(b) Write equation leading towards formation of Nylon-6,10.

(1 mark)

(c) (i) Name the type of polymerization involved in formation of Nylon-6,10

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

(ii) State one use of Nylon-6,10.

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

(9) Potassium permanganate is preferred to potassium dichromate in standardizing sodium ethanedioate although it's not considered as a primary standard.

(a) Explain what is meant by the term **primary standard**.

(1 mark)

(b) State reason(s) why potassium permanganate is preferred to potassium dichromate.

(1 mark)

(c) (i) State the condition(s) for the reaction of potassium permanganate with sodium ethanedioate

(1 mark)

(ii) Write equation for the reaction that takes place in c (i).

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

SECTION B (54 marks)

Answer **six** questions

(10) (a) Explain what is meant by the term **partition coefficient**.

(1½ marks)

(b) An experiment to investigate the distribution of ammonia between an aqueous layer of 0.2M Cu^{2+} ions and CHCl_3 was performed. Equilibrium was established and the results are shown in the table.

Concentration of NH_3 in 0.2M $\text{Cu}^{2+}(\text{aq})/\text{mol l}^{-1}$	1.34	1.6	2.10	2.37	2.90
Concentration of NH_3 in $\text{CHCl}_3/\text{mol l}^{-1}$	0.02	0.03	0.05	0.06	0.08

(i) Plot a graph of concentration of NH_3 in 0.2M $\text{Cu}^{2+}(\text{aq})$ against concentration of NH_3 in CHCl_3 . (3 marks)

(ii) Determine the distribution constant k_D of NH_3 between water and CHCl_3 .

(2 marks)

(iii) Calculate the value of x in $[\text{Cu}(\text{NH}_3)_x]^{2+}$

(1½ marks)

(iv) State one application of partition coefficient apart from solvent extraction.

(1 mark)

(11) Write equations to show how the following synthesis can be carried out. In each case indicate the reagents and conditions necessary.

(a) 2-methyl propanoic acid from chloro propane

(4¹/₂ marks)

(b) Methylamine from ethanoic acid.

(2 marks)

(c) Chloro benzene to benzene.

(2¹/₂ marks)

(12) The elements fluorine, chlorine and bromine are some of the elements that belong to group (VII) of the periodic table.

(a) State and explain the variation in atomic radii among the above given elements.

(2¹/₂ marks)

(b) State how each of chlorine and bromine can be prepared. Write equation for the reaction that takes place in each case.

Chlorine

(2¹/₂ marks)

Bromine

(2¹/₂ marks)

(c) State any **three** reasons why the chemical properties of fluorine differ from those of other members of the same group.

(1¹/₂ marks)

(13) (a) Explain what is meant by the term **enthalpy of atomization**.

(1 mark)

(b) Draw a born Haber cycle showing energy changes that occur during enthalpy of formation of silicon (IV) chloride. Indicate the energy changes involved.

(2 marks)

(c) The following enthalpy changes are given;

Enthalpies of atomization of chlorine is **+121** kJ mol⁻¹ .

The bond energy of Si-Cl = **402** kJ mol⁻¹

Enthalpy of formation of silicon (iv) chloride = **-640** kJ mol⁻¹

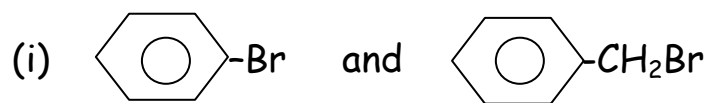
Calculate the enthalpy of atomization of silicon.

(3marks).

(d) Silicon (iv) chloride fumes in moist air. Explain this observation.

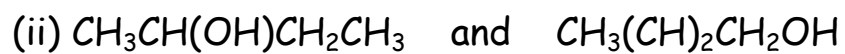
(3marks).

(14) (a) Name the reagent(s) that can be used to distinguish between the following pair of compounds. In each case state the observations made.



Reagent

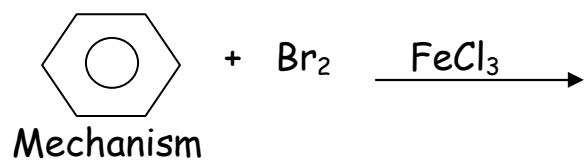
Observation



Reagent

Observation

(b) Complete the following equation and write a mechanism for the reaction.



(3 marks)

(15) (a) Explain what is meant by the term **transition metal**.

(1 mark)

(b) Both copper and zinc are d-block elements however zinc is not considered as a transition metal whereas copper is.

State the reason why;

(i) copper is considered as a transition metal.

(1½ marks)

(ii) zinc is not considered as a transition metal

(1½ marks)

(c) State what will be observed and write equation for the reaction that takes place when to aqueous solution of copper(II) ethanoate is added;

(i) potassium hexacyanoferrate (II) solution

Observation

(1 mark)

Equation

(1½ marks)

(ii) concentrated hydrochloric acid.

Observation

(1 mark)

Equation

(1½ marks)

(1) (a) Explain what is meant by the term **salt hydrolysis**.

(1 marks)

(b) Sodium benzoate undergoes hydrolysis when dissolved in water.

Write ;

(i) equation for hydrolysis of sodium benzoate.

(1 mark)

(ii) expression for hydrolysis constant K_h of sodium benzoate.

(1 mark)

(c) 36g of sodium benzoate was dissolves in 2½ litres of water.

(i) State whether the PH of the solution formed is equal to, greater or less than 7?

Give reason for your answer.

(2 marks)

(ii) Calculate the PH of the solution.

(K_w for water = 1.0×10^{-14} and K_a for benzoic acid = 6.25×10^{-5})

(4 marks)

(17) During extraction of zinc from its ore, the ore dried, grounded and then concentrated. The concentrated ore is mixed with coke and limestone then heated in blast furnace.

(a) Write the name and formula of the ore from which zinc is extracted.

(1 mark)

(b)(i) Name the process by which the ore is concentrated.

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

(ii) Explain briefly how the named process in (i) is carried out

($3\frac{1}{2}$ marks)

(c) Name the **two** substances which are mixed the product formed after roasting the ore before being heated in the blast furnace .

(1 mark)

(d) Write other equations involved leading towards formation of zinc in the blast furnace from the product formed after the ore has been roasted.

(3 marks)

END