P525/2

CHEMISTRY

Paper 2

2½ hours.

Uganda Advanced Certificate of Education

PRE MOCK CHEMISTRY

(Principal Subject)

Paper 2

2 hours 30 minutes.

INSTRUCTION TO CANDIDATES:

- Answer **FIVE** questions including three questions from section **A** and any **two** from section **B.**
- Begin each question on a fresh page.
- Mathematical tables and graph papers are provided.
- Non-programmable scientific electronic calculators may be used.
- Where necessary use the following values

Al = 27, Br = 80, C = 12, H = 1, O = 16

SECTION A

(Answer three questions from this section)

1. (a) What do you understand by the term "standard electrode potential"? (2 marks)

(b) Draw a well labeled diagram to show how the standard electrode potential could be determined for $Pb^{2+}_{(aq)}$ / $Pb_{(s)}$ electrode. (8 marks)

(c) The standard electrode potentials for some electrodes are given below:

$Pb^{2+}_{(aq)}$ /$Pb_{(s)}$	$E\theta$ = -0.14V
$Zn^{2+}_{(aq)}$ / $Zn_{(s)}$	$E\theta$ = -0.76V
$Mg^{2+}_{(aq)}$ / $Mg_{(s)}$	$E\theta$ = -2.34V

(i) Which of the species listed above is the strongest oxidizing agent? (2 marks)

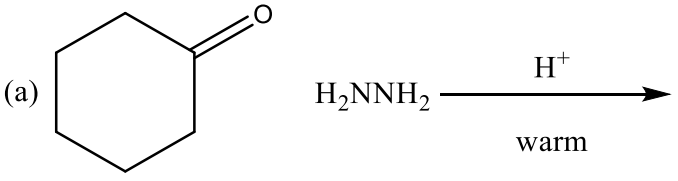
(ii) Construct a cell notation for the cell between $Pb^{2+}_{(aq)}$ /$Pb_{(s)}$ and $Zn^{2+}_{(aq)}$ / $Zn_{(s)}$ electrodes. (2 marks)

(iii) Calculate the cell voltage for the cell. (2 marks)

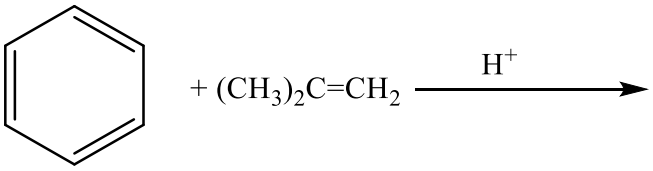
(iv) Write an ionic equation for the reaction that takes place. (2 marks)

(v) A piece of magnesium ribbon was placed in the beaker containing lead ions while the above circuit is in operation. Discuss what would be observed in the beaker containing lead ions. (2 marks)

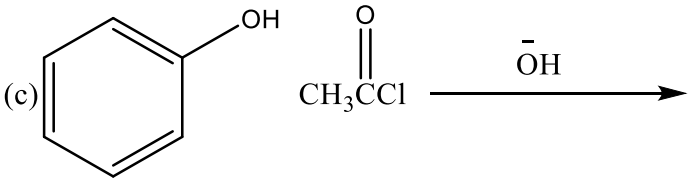
2. Complete each of the following equations and in each case outline a possible mechanism for the reaction.

(a) 

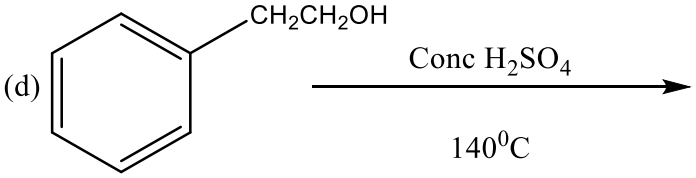
(5 mark)

(b) 

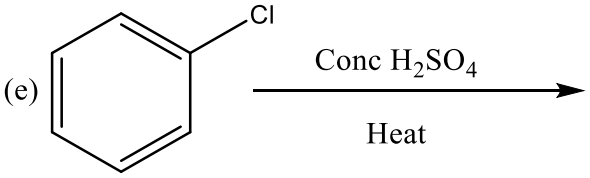
(3 ½ marks)

(c) 

(3 marks)

(d) 

(3 ½ marks)

(e) 

(4 ½ marks)

3. (a) Write

(i) The electronic configuration of chromium atom. (1 mark)

(atomic number of Cr = 24)

(ii) The possible oxidation states of chromium. (1 ½ marks)

(b) (i) Write down the half equation for the reduction of potassium dichromate in acidic medium. (1 ½ marks)

(ii) What is the change in oxidation state of Chromium in the reaction in b(i) above? (1 mark)

(c) State what is observed and in each case write the equation for the reaction that takes place when;

(i) aqueous sodium hydroxide is added to a solution of $Cr_2O_7^{2-}$ ions.

(2 ½ marks)

(ii) aqueous sodium hydroxide is added to a solution of Cr^{3+} ions dropwise until in excess (4 ½ marks)

(iii) dilute sulphuric acid is added to a solution of CrO_4^{2-} ions.(2 ½ marks)

(d) Describe, using equations, the amphoteric nature of Chromium(iii) oxide. (4 ½ marks)

4. (a) (i) Explain the term partition coefficient (2 ½ marks)

(ii) State the limitations of the partition law. (2 marks)

(b) Describe how the partition coefficient of ammonia between water and trichloro-methane can be determined. (6 ½ marks)

(c) $25cm^3$ of excess ammonia solution was added to $25cm^3$ of 0.1M copper(ii) sulphate solution. The resulting deep blue solution was shaken with $50cm^3$ of trichloromethane and the mixture was allowed to settle. $50cm^3$ of the trichloromethane layer needed $25.5cm^3$ of 0.05M hydrochloric acid for neutralization. $20cm^3$ of the aqueous layer was neutralized by $33.3cm^3$ of 0.5M hydrochloric acid. (The distribution coefficient of ammonia between water and trichloromethane was 25 at that temperature).

(i) Find the formula of the complex formed. (8 marks)

(ii) Write the equation(s) leading to the formation of the complex. (1 mark)

SECTION B

Answer two questions from this section.

5. (a) (i) What is meant by the term “binding energy” (2 marks)

(ii) List three characteristics of stable nuclei. (3 marks)

(b) Briefly explain how a nucleus can gain stability if it has

(i) excess protons

(ii) excess neutrons

(c) The table below shows how the activity of iodine-128 varies with time.

Time/S	500	2000	3000	4000	6000	8000
Activity / counts/S	146	75	45	27	10	4

(i) Plot a graph of activity against time. (3 marks)

(ii) Use your graph to determine the half-life of iodine – 128. (1 mark)

(iii) Determine the decay constant for iodine-128

(d) The following is a list of elements near iodine in the Periodic Table with their atomic numbers.

Tin	Antimony	Tellurium	Iodine	Xenon	Caesium	Barium
50	51	52	53	54	55	56

What would be the new element if iodine were to decay by

(i) β emission? (2 marks)

(ii) α emission? (2 marks)

(e) State two differences between α and β particles (1 mark)

6. The table below shows the hydrides of group VII elements and their boiling points.

hydride	Boiling point/K
HF	253
HCl	188
HBr	206
HI	238

(a) Explain the trend in boiling points. (4 marks)

(b) The hydrides form acidic solutions when dissolved in water.

(i) Arrange the hydrides in order of acid strength. (1 mark)

(ii) Give reasons for your answer in b(i) above. (1 mark)

(c) (i) Write an equation for the preparation of hydrogen fluoride from calcium fluoride and sulphuric acid. (1 ½ marks)

(ii) Explain why hydrogen bromide and hydrogen iodide are not prepared by this method. (2 ½ marks)

(iii) How can hydrogen bromide be prepared? (2 marks)

(d) Hydrogen iodide gas is 20% dissociated at 1300K.

(i) Write the equation for the dissociation of hydrogen iodide. (3 marks)

(ii) Write down the expression for the dissociation constant Kp in terms of α, the degree of dissociation and P, the total pressure. (3 marks)

(iii) Calculate the value of Kp at 1300K and a total pressure of one atmosphere. (2 marks)

(iv) What would be the effect on the position of the equilibrium if the concentration of hydrogen iodide is reduced? (1 mark)

7. Explain each of the following observations.

(a) When excess carbon-dioxide is passed through a solution of sodium hydroxide a white precipitate is formed. (4 marks)

(b) When a concentrated solution of tin(ii)chloride is diluted, a white precipitate is formed. (2 ½ marks)

(c) The melting point of 2-hydroxybenzaldehyde is much lower than that of 4-hydroxybenzaldehyde. (3 marks)

(d) When sodium hydroxide solution is added to a solution of tin(ii) chloride a white precipitate is formed which dissolves in excess alkali. (4 marks)

(e) Copper(i) chloride is a white solid whereas copper(ii) chloride is a green solid. (3 marks)

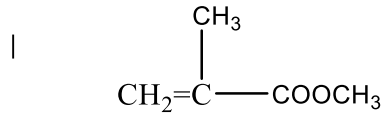
(f) The first election affinity of oxygen is negative but the second electron affinity is positive. (3 ½ marks)

8. (a) Explain what is meant by

(i) Polymerisation (2 mark)

(ii) Copolymer (2 marks)

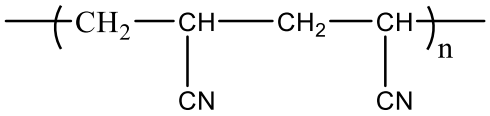
(b) Perspex is made from the substance



(i) What is the name of this substance? (2 marks)

(ii) What is the formula of Perspex? (2 marks)

(c) Orlon has the following structure:



What is the formula of the orlon monomer? (2 mark)

(d) A sample of polystyrene (Polyphenylethene) is found to consist of molecules with an average molecular mass of 12480.

(i) Write down the repeating unit in polystyrene. (2 marks)

(ii) How many polystyrene monomers are present in each polymeric unit? (2 mark)

(e) Explain the differences in properties of thermosetting and thermosoftening plastics. (6 marks)

END