

P525/2

CHEMISTRY

Paper 2

August 2024

2½ hours.



NATIONAL EDUCATION RESEARCH & EXAMINATIONS BUREAU

UACE NEREB NATIONAL MOCKS 2024

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**.
- Write answers in the answer booklet provided
- Begin each question on a fresh page.
- Mathematical tables and graph papers are provided.
- Non-programmable scientific electronic calculators may be used.
- Use equations where necessary to illustrate your answers
- Where necessary use (Cu = 64, S = 32, O = 16, Br = 79.9. H = 1)
- Faraday's constant is 96500c

SECTION A

(Answer three questions from this section)

- 1 (a) State Hess's law of constant heat summation. (01 mark)
- (b) Explain what is meant by each of the following terms and in each case write an equation to illustrate your answer.
- (i) Hydration energy (02 marks)
- (ii) Lattice energy (02 marks)
- (c) Explain two factors that affect the value of lattice energy of a compound (03marks)
- (d) In an experiment to determine lattice energy of anhydrous copper (II) sulphate, 4.0g of anhydrous copper (II) sulphate was added to 50g of water and the temperature rose by 8.0°C. When 4.0g of hydrated copper (II) sulphate was added to 50g of water and the temperature of water dropped from 24.5°C to 23.6°C.
[$S.H.C \text{ of solution} = 4.2 J g^{-1} K^{-1}$]
Calculate the enthalpy of solution of;
- (i) Anhydrous copper(II) sulphate (03 marks)
- (ii) Copper(II) sulphate-5-water (03 marks)
- (e) (i) State which one of the two copper(II) salts in (d) is more soluble in water and explain your answer. (03 marks)
- (ii) Using a Born-Haber cycle determine the hydration energy of anhydrous copper (II) sulphate. (03 marks)
- 2 (a) Both phenol and ethanol contain the same functional group.
- (i) Name one reagent that can be used to distinguish between the two compounds. (01 mark)
- (ii) State what would be observed if each of the compounds is treated with the reagent you have named and write the equation for the reaction that occurs if any. (03 marks)
- (iii) Describe three ways in which the chemistry of phenol is similar to that of ethanol. (03marks)
- (iv) Mention two use of phenol. (02 mark)
- (b) An aqueous solution of phenol turns blue litmus paper red whereas that of ethanol has no effect. Explain this observation. (04 ½ marks)
- (c) Write the equation and mechanism for the reaction between
- (i) Phenol and 2-chloro propane in alkaline conditions (02 marks)
- (ii) Ethanol and methanoic acid in presence of sulphuric acid (04 ½ marks)
- 3 (a) Write the general outer most electron configuration of group (iv) elements ($\frac{1}{2}$ mark)
- (b) Describe the reactions of;
- (i) Carbon, silicon, tin and lead with water (6½marks)

- (ii) Lead with ethanoic acid (02marks)
- (iii) Chlorides of lead with dilute sodium hydroxide solution (04 marks)
- (iv) Lead (IV) oxide with concentrated hydrochloric acid (05marks)
- (v) Silicon with acids (02 marks)

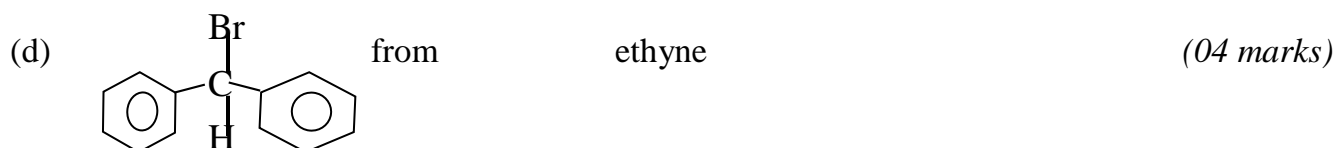
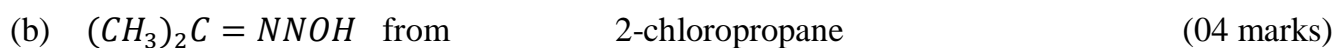
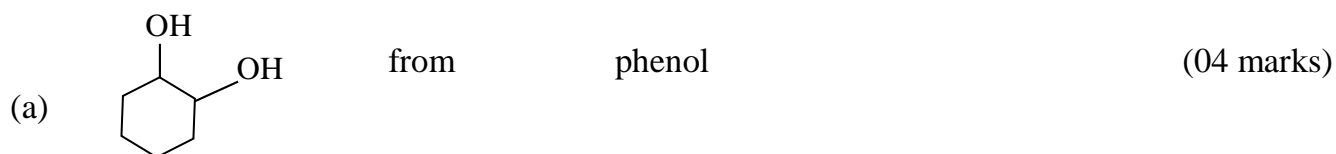
4 Explain each of following observations;

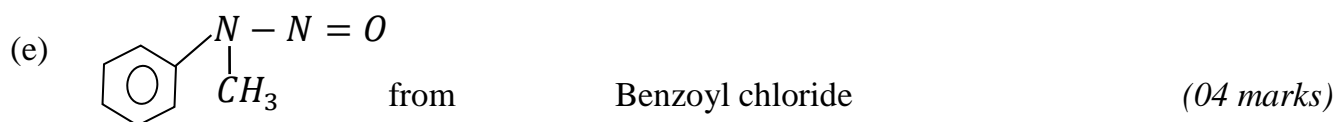
- (a) When propanone was mixed with trichloromethane, a warm miscible mixture was formed whose volume was lower than the sum of the volumes of the individual components (04 marks)
- (b) Methanoic acid forms a silver mirror with Tollen's reagent while ethanoic acid gives no observable change (04 marks)
- (c) Hydrofluoric acid is a weak acid but its strength increase with increase in concentration (05marks)
- (d) A mixture of benzene (boiling point 80°C) and water (boiling point 100°C) boils at a temperature of 70°C (03 marks)
- (e) Phenyl amine is a weaker base than Ethyl amine (04 marks)

SECTION B

Answer **two** questions from this section.

5 Write equations to show how each of the following compounds can be synthesized. In each case indicate the reagent(s) and condition(s) for the reaction.





6. (a) Zinc is a d-block element but not a typical transition metal element. Briefly explain the terms;
- (i) d-block element (01 mark)
 - (ii) Transition element (01 mark)
- (b) Explain why zinc is not considered a typical transition element (1½ marks)
- (c) (i) Describe three ways in which the chemistry of zinc is similar to that of magnesium (7½ marks)
- (ii) State what would be observed and write the equation(s) for the reaction that occurs when dilute aqueous ammonia solution is added drop wise until in excess to an aqueous solution of zinc sulphate. (03 marks)
- (d) (i) 3.0g of a zinc ore was dissolved in excess concentrated ammonia and the solution was made up to 500cm³ with water. The resultant solution was shaken with carbon tetrachloride and left to stand. 25cm³ of the organic layer required 12.50cm³ of 0.025M hydrochloric acid for complete neutralization. 12.5cm³ of the aqueous layer was neutralised by 20.0cm³ of 0.25M hydrochloric acid. Calculate the percentage of zinc in the ore.
- (The partition coefficient of ammonia between carbon tetrachloride and water = 0.04)** (05 marks)
- (ii) State any other two applications of the partition coefficient (02 marks)
7. (a) The standard electrode potential for some half cells are shown below;
- | | |
|-----------------------------------|--------|
| $Fe^{3+}_{(aq)} / Fe^{2+}_{(aq)}$ | +0.76V |
| $I_{2(aq)} / I^{-}_{(aq)}$ | +0.54V |
- (i) What is meant by the term standard electrode potential (01 mark)
 - (ii) Using a well labeled diagram describe how the standard electrode potential of iron (III) sulphate can be determined (06 marks)
 - (iii) Why is it not possible to measure the standard electrode potential of iron(III) sulphate absolutely? (02 marks)
- (c) (i) Write the cell convention and the equation for the overall reaction that occurs when the electrode potentials in (a) above are combined (2½ marks)
- (ii) Calculate the overall electrode potential for the cell (1½ marks)
- (iii) State whether the reaction in c(i) is feasible or not. Give a reason for your answer. (01 mark)

- (d) A current of 40.5A was passed through molten lead (II) bromide for 4 hours and the bromine liberated reacted with 94.0g of hydroxyl benzene. Calculate the number of moles of;
- (i) Bromine liberated
 - (ii) Hydroxy benzene that reacted (04 marks)
- (e) State what is observed and write equation for the reaction that took place between Bromine and hydroxy benzene in (d) above. (02 marks)

8 Soap can be prepared from fats and oils

- (a)
 - (i) State one differences between fats and oil (01 mark)
 - (ii) Name two source of vegetable oil (02 mark)
- (b)
 - (i) What is the chemical nature of all soaps (01 mark)
 - (ii) Give a chemical name of an example of soap (01 mark)
- (c) Soap was prepared from 9.5g of oil containing mainly Hexadecanoic acid $[CH_3(CH_2)_{14}CO_2H]$ as the main component of the oil.
 - (i) Explain briefly how pure soap was obtained from oil (04 marks)
 - (ii) Calculate the mass of the soap formed (03 marks)
 - (iii) Name two use of the residue left after the oil has been extracted (01 marks)
- (d)
 - (i) Explain clearly how soap or detergents remove grease particles during process of washing. (03 marks)
 - (ii) Explain the difference between soap and detergents. (02marks)
 - (iii) Give one advantage and disadvantage of using detergents. (02 marks)