P525/2 **SCOBA**

CHEMISTRY

Paper 2

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

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

SECTION A

(Answer three questions from this section)

1. The conversion of gaseous nitrogen and hydrogen to ammonia is accompanied by the evolution of 46KJ per mole of ammonia formed.

   (a) Write

   (i) a balanced equation for the reaction that takes place.

   (ii) an expression for the equilibrium constant Kp.

   (b) If an ammonia plant produces 10^6kg of ammonia per day by this process, how much heat is liberated?

   (c) When 3 moles of hydrogen and 1 mole of nitrogen were explored together at a pressure of 10MPa and a temperature of 300^{o}C, 50% of nitrogen and hydrogen had become ammonia at equilibrium. Calculate the equilibrium constant Kp.

   (d) Describe and explain what would happen to

   (i) the value of Kp.

   (ii) the equilibrium position

   (iii) the rate of attainment of equilibrium if the temperature is increased from 300^{o}C to 500^{o}C.

2. (a) Explain what is meant by

   (i) strong electrolyte

   (ii) weak electrolyte

   (b) State four factors that affect conductivity of an electrolyte.

   (c) Explain how the factors you have stated in (b) above affect the conductivity of an electrolyte.

   (d) A solution containing 0.095gl^{-1} of magnesium chloride has an electrolytic conductivity of 2.58 x 10^{-4} Ω^{-1} cm-1. If the molar ionic conductivity of magnesium ions is 106 Ω^{-1}cm^{2}mol^{-1}, determine the molar ionic conductivity of chloride ions.

   (e) State three uses of conductivity measurements.

   (f) A current of 0.1A is passed through a solution of nickel ions for 16 minutes 5 seconds and 0.0294g of nickel was deposited on the cathode. Determine the charge on the nickel ion in this solution.

   (Ni=58.7, Farady constant = 96500Cmol^{-1})

3. (a) Write equations for the following reactions.

(i) Calcium oxide reacts with carbon to give calcium carbide which reacts with water to give ethyne.

(ii) Aluminium combines directly with carbon at 1600^{o}C to give aluminium carbine on hydrolysis the carbide gives an inflammable gas.

(iii) The carbide of magnesium gives prop –1-yne on hydrolysis.

(b) What do you understand by the term first electron affinity?

The table below shows the first electron affinities of the elements of Period 2 of the Periodic Table.

Periodic Table.

Element	Li	Be	B	C	N	O	F
First electron affinity	-59.8	+66	-29.0	-120	-3.0	-142	-348

(i) Write an equation for the first electron affinity of nitrogen.

(ii) State and explain the trend of first electron affinities of the elements.

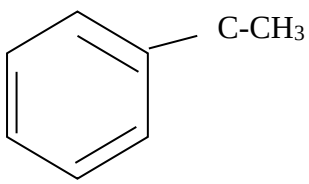
(iii) Why are the second electron affinity values positive for all the elements.

4. Complete the following equations and in each case outline the mechanism for the reaction.

(a) 

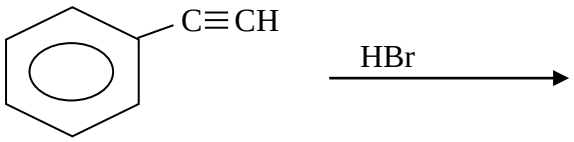
(4 marks)

(b) $CH_3\overset{\overset{O}{||}}{C}CH_3$ $\xrightarrow{NaOH}$ (3 ½ marks)

(c) 

(3 ½ marks)

(d) $CH_3CH_2CH_2CH_2OH \xrightarrow[180^{o}C]{Conc\ H_2SO_4}$ (4 marks)

(e) 

(5 marks)

5. Explain each of the following observations

(a) Silver chloride dissolves in ammonia solution but silver iodine does not.

(b) Chlorine and methane react rapidly when exposed to strong sunlight.

(c) Pure hydrogen bromide is not readily obtained by the action of concentrated sulphuric acid on sodium bromide.

(d) Sulphuric acid and hydrochloric acid are equally strong, yet hydrogen chloride is evolved by action of concentrated sulphuric acid on sodium chloride.

(e) Although the ceasium ion is larger than the lithium ion the conductivity of ceasium is greater than that of the lithium ion.

6. The elements fluorine, chlorine, bromine and iodine belong to group VII of the Periodic table.

(a) Write the general outermost electronic configuration of the elements.

(b) Fluorine shows only one oxidation state of -1 but the others show-1 and higher oxidation states. Explain

(c) Explain the following observations:

(i) Chloride is much more soluble in sodium hydroxide than it is in water.

(ii) Iodine is only sparingly soluble in water but dissolves readily in aqueous potassium iodine.

(iii) Unlike the other halogens, fluorine liberates oxygen from cold water.

(d) When iodine is added to aqueous sodium hydroxide, the initial product disproportionate. Explain the meaning of this term and write ionic equation(s) for the changes that take place.

(e) The standard electrode potential for some half cell reactions are given below:

$\frac{1}{2}Cl_{2(g)} + e^- \rightleftharpoons Cl^-_{(aq)} E^\theta = 1.36V$

$MnO_4^-(aq) + 8H^+_{(aq)} + 5e^- \rightleftharpoons Mn^{2+}_{(aq)} + 4H_2O_{(l)} E^\theta + 1.52\gamma$

(i) Use the above data to explain the fact that chlorine may be prepared by the action of potassium manganate (VII) on hydrochloric acid.

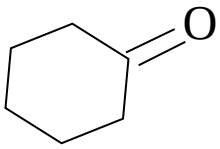
(ii) Write the overall equation for the reaction.

7. Write equations to show how the following compounds can be synthesized.

(a) $CH_3C{\equiv}C\ CH_2Ch_3$ from $CH_3CH_2ChBr_2$ (7 marks)

(b) $CH_3Ch{=}CHC(=O)H$ from CH_3Ch_2Br (5 marks)

(c) Benzene from $CH_3COOCH_2CH_3$ (5 marks)

(d)  from bromocyclohexane. (3 marks)

8. The most important ore of copper is copper pyrites.

(a) (i) Write down the formula of copper pyrites.

(ii) Describe concisely how pure copper can be extracted from copper pyrites (write equations for the reactions that take place).

(b) The extraction of copper from copper pyrites releases a lot of sulphurdioxide that can be used as a starting material in the contact process.
Write the equations that lead to the sulphur dioxide.

(c) State what is observed and write equation for the reaction that takes place when aqueous ammonia is added to copper(II) sulphate solution dropwise until in excess.