P525/2
Chemistry
Paper 2
Aug 2004 Mock Exams
2 ½ hours

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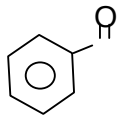
UGANDA ADVANCED CERTIFICATE OF EDUCATION
MOCK EXAMS 2004
CHEMISTRY
(PRINCIPAL SUBJECT)
PAPER 2
2 HOURS 30 MINUTES

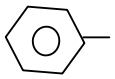
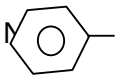
INSTRUCTIONS TO CANDIDATES:
Answer five questions, including three from section A and any two from section B
Begin each question on a fresh page
Non-programmable scientific electronic calculator may be used.

SECTION A:
Answer three questions from this section

1. Write equations to show how the following compounds can be synthesised.
   (a) CH_3COOH from propan – 2 – ol (5 marks)

   (b)  C – O – CH_3 to  (4 marks)

   (c) $CH_3CH_2CH_2OH$ to $CH_3CH_2CH_2NH_2$ (4 marks)

   (d)   OH from phenylamine (4 marks)

   (e) $CH_3CH_2CH_2OH$ to $CH_3\underset{\underset{OH}{|}}{C}HCH_3$ (3 marks)

2. The elements beryllium, magnesium, calcium and barium belong to group II in the periodic table
   (a) (i) By means of equations, state three chemical properties shown by the elements (4 marks)
   (ii) State and explain the trend in the solubilities of the sulphates of the elements in water (3 marks)

(b) Beryllium differs in some of its properties from the rest of the elements in the group, it instead resembles Aluminium a group III element

(i) Explain why the chemistry of Beryllium and Aluminium resemble (3 marks)

(ii) State four properties in which the chemistry of Beryllium resemble those of Aluminium (4 marks)

(c) Explain the following observations

(i) Salts of group II elements are generally less soluble in water than their corresponding group I salts. (3 marks)

(ii) Calcium sulphate is less soluble in water than calcium chloride (3 marks)

3. (a) (i) Explain what is meant by the term lattice energy (2 marks)

(ii) State two factors that affect the magnitude of lattice energy (2 marks)

(iii) Describe how the factors you have stated in (ii) affect lattice energy (4 marks)

(b) (i) Draw and label carefully a born-Haber cycle for the formation of calcium oxide from its elements.

(ii) Use the data below to calculate the value of the lattice energies of calcium oxide and iron (II) oxide

Standard enthalpy change of formation (CaO) = – 635 (FeO) = –278 $^{-1}$
Standard enthalpy change of atonisation (Ca) = +178 (Fe) = + 416Kjmol $^{-1}$
Standard molar 1st + 2nd ionisation energies (Ca) = +1735 (Fe) = +230Kjmol^{-1}
Standard molar 1st + 2nd electron affinities (O) = 657Kjmol^{-1} of O atoms (6 marks)

(c) calculate the heat of hydrogenation of ethyne to ethene from the following thermodynamic data:

$C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_{2(g)} + 2H_2O_{(l)}$ $\Delta H = -1393$ Kjnol $^{-1}$

$C_2H_{2(g)} + 2\frac{1}{2} O_{2(g)} \longrightarrow 2CO_{2(g)} + H_2O_{(l)}$ $\Delta H = -1310$Kjmol $^{-1}$

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -285$Kjmol $^{-1}$

4. Explain each of the following observations

(a) Aluminium hydroxide is soluble in dilute sodium hydroxide solution, yet insoluble in aqueous ammonia whereas zinc hydroxide readily dissolves in both

(b) Lead (II) chloride is less soluble in dilute hydrochloric acid than in water, yet is quite soluble in concentrated hydrochloric acid

(c) Both 2 – nitrophenol and 4 – nitrophenol exhibit hydrogen bonding and yet the boiling points of the two compounds differ greatly

(d) Addition of Ammonium thiocyanate to an aqueous solution of iron (III) chloride produces a blood red solution.

(e) Methanoic acid reacts with ammoniacal silver nitrate solution whereas ethanoic acid does not

SECTION B:
Answer two questions from this section

5. (a) A compound Q, $C_7H_{14}O_2$ reacted with sulphuric acid on heating to form compounds A, $C_4H_{10}O$ and B, $C_3H_6O_2$. A reacted with sodium with effervescence but had no effect on litmus solution
   (i) Write the names and structural formulae of all the possible isomers of A (4 marks)
   (ii) Name a reagent that can be used to distinguish between the isomers in (i) and state what would be observed if the isomers in (i) are reacted with the reagent (4 marks)

   (b) A reacted with acidified dichromate solution to give D, which formed a yellow solid when reacted with alkaline iodine solution
   (i) identify A, D and the yellow solid. (3 marks)
   (ii) name one reagent that can be used to identify the functional group in D (1 mark)

   (c) Write equations and indicate a mechanism for the reaction between D and A
   (i) 2,4 – Dinitrophenylhydrazine (5 marks)
   (ii) sodium hydrogen sulphite (3 marks)

6. (a) The table below shows the solubilities of salt A and salt B at different temperatures

Temperature (oC)		0	10	20	30	40	50	60
Solubility (g per 100g of water)	Salt A	13	20	32	45	63	85	110
	Salt B	32.5	34	35	36	37	38	39

   (i) Plot a graph of solubility against temperature for salt A and salt B using the same axes. (4 marks)
   (ii) A saturated solution of salt A was cooled from 45^oC to 25^oC Determine the mass of salt deposited (2 marks)

   (b) Explain how a pure sample of salt A can be obtained from a mixture containing salts A and B. Name one method that can be used to test for the purity of the separated sample. (8 marks)

   (c) $20.00cm^3$ of a 0.01M potassium permanganate (VII) solution required exactly $16.65cm^3$ of a solution containing 4.8g per litre of an oxalate $(COO^- x^+)_2.2H_2O$. Calculate the atomic mass of x. (6 marks)

7. (a) Explain what is meant by
   (i) First ionisation energy (3 marks)
   (ii) Atomic radius (4 marks)

   (b) Explain how first ionisation energy and Atomic radius vary
   (i) Across period 2 (5 marks)
   (ii) Down group (VII) (5 marks)

(c) State three information in determining the chemistry of an element obtainable from ionisation potential values of the element. (3 marks)