P525/2
CHEMISTRY
Paper 2
June / Julyl 2017
2½ hours

UACE RESOURCEFUL MOCK EXAMINATION

CHEMISTRY

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:
Answer **five** questions including **three** questions from section **A** and any **two** questions from section **B**.
Begin **each** question on a **fresh page.**
Mathematical tables and graph papers are provided.
Non- programmable scientific electronic calculator may be used.
Illustrate yours answers with equations where applicable.
Where possible use H = 1, C = 12, N = 14, O = 16, Na = 23,
Cl = 35.5 ,Al = 27
1 mole of a gas occupies 22.4dm^3 at s.t.p
1 mole of a gas occupies 24dm^3 at room temperature
Molar gas constant = 8.314$JK^{-}mol^{-1}$

Indicate the questions attempt in the grid below.

Questions						Total
Marks						

Turn Over

SECTION A

*Answer **three** questions from this section.*

1. (a) Write the outer most electronic configuration of Group I and Group II Elements. (02marks)

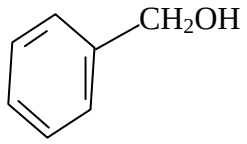
(b) Describe the reactions of lithium and sodium with:.

(i) air
(ii) bromine
(iii) nitrogen gas. (06marks)

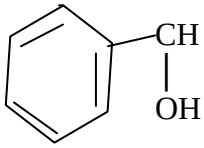
(c) Briefly describe how sodium hydroxide can be manufactured on a large scale. (06marks)

(b) Describe the reactions of group II elements with water. (06marks)

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

(a) 

from benzene (04 marks)

(b) 

from benzoic acid (04marks)

(c) Cyclohexane- 1,2- diol from phenol (04 marks)

(d) 2,2- dichloropropane from propan-1- ol (04 marks)

(e) Propan- 1- ol from propyne (04 marks)

3. (a) Ammonia is a weak base.

(i) What is meant by the term weak base? (01mark)
(ii) Write equation for the ionization of ammonia in water. (01mark)
(iii) Write an expression for base ionization constant for ammonia. (01mark)

(b) Calculate the pH of

(i) a 0.02M ammonia solution (2½marks)

(ii) a solution made mixing $35cm^3$ 0.02M ammonia solution and $15cm^3$ of 0.02M ammonium chloride solution. (3½marks)

(Kw = 1.0×10^{-14} and pKb for ammonia = 4.74)

(c) Comment on the answer in (b) (04marks)

(d) (i) Sketch a graph of pH against volume of hydrochloric acid when ammonia solution is being titrated with hydrochloric acid. (02marks)

(ii) Explain the shape of the graph. (05marks)

4. **(**a) State **three** characteristics of equilibrium reactions. (1½ marks)

(b) Nitrogen react reversibly and exothermically with hydrogen to form ammonia .

(i) State **two** conditions necessary for optimum yield of ammonia. (02marks)

(ii) Write equation for reaction leading to the formation of ammonia. (1½ marks)

(iii) Write the expression for the equilibrium constant in terms of partial pressures. (01mark)

(c) State and explain how the following changes affect the equilibrium position and equilibrium constant for the reaction in b(ii) above.

(i) Increasing the pressure . (2 ½marks)

(i) Increasing the temperature . (2½marks)

(ii) Adding the finely divided iron (01 mark)

(d) 1 mole of nitrogen gas was mixed with 2 moles of hydrogen gas at 600℃ and 10atm, and the system allowed to attain equilibrium. The equilibrium mixture was found to contain 30.95% nitrogen.

Calculate the value of K_p at 600℃ and clearly state its units. (05 marks)

(e) Using equations, show how nitric acid can be manufactured from ammonia. (03 marks)

SECTION B

*Attempt any **two** questions from this section.*

5. Propanone reacts with iodine in the presence of dilute sulphuric acid according to the following equation.

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3\,(aq) + I_2(aq)) \xrightarrow{H^+(aq)} CH_3 - \overset{\overset{O}{\|}}{C} - CH_2I\,(aq) + HI(aq)$$

The reaction is first order with respect to propanone and zero order with respect to iodine.

(i) Explain what is meant by the term **order of reaction.** (02mark)

(ii) Write the expression for the rate law for the reaction. (01marks)

(iii) Describe an experiment to show how you would determine the order of reaction with respect to iodine. (06marks)

(b) The rate equation for a reaction between substances A, B and C is in the form:

Rate $= k [A]^x[B]^y[C]^z$ where $x + y + z = 4$

The following data were obtained in a series of experiments at a constant temperature.

Experiment	Initial concentrations of **A**/ moldm^{-3}	Initial concentration of **B** / moldm^{-3}	Initial concentration of **C** / moldm^{-3}	Initial rate / moldm^{-3} s^{-1}
1	0.10	0.20	0.20	8.0×10^{-5}
2	0.10	0.05	0.20	2.0×10^{-5}
3	0.05	0.10	0.20	2.0×10^{-5}
4	0.10	0.10	0.10	y

(i) Use the data in the table to deduce the order of reaction with respect to **B** and the order of reaction with respect to **A.** Hence deduce the order of reaction with respect to **C**. (03marks)

(ii) Determine the value of y. (02marks)

(ii) Calculate the value the rate constant k , and state its units. (03marks)

(iii) How does the value of k change when the temperature of the reaction is increased? (01mark)

(c) The integrated rate equation for the first order reaction is given by the expression $2.303\log_{10}\left(\frac{C_o - x}{C_o}\right) = -kt$; where C_o is the initial concentration of the reactant and ($C_o - x$) is the concentration of the

reactant after time $t > 0$

(i) derive an expression for the half- life for the reaction. (02marks)

(ii) calculate the time taken for the concentration of the reactant to decrease to one third of its initial concentration if the rate constant is $2.0 \times 10^{-5}\ s^{-1}$. (02marks)

6. An organic compound **Y** on complete combustion yielded 22g of carbon dioxide and 3.375g of water. When vaporized at $65^{o}C$ and 750mmHg, 0.2g of **Y** occupied a volume of $55.11cm^3$.

(a) Calculate the

(i) empirical formula of **Y**. (03marks)

(ii) determine the molecular formula of **Y.** (03marks)

(b) **Y** burns with a sooty flame. Write name and structural formula of **Y**. (01mark)

(c) Name a reagent that can be used to test the function group in **Y** and state what would be observed and write equation for the reaction that take place.. (03marks)

(d) Write equation and suggest a mechanism for the reaction between Y and excess

(i) bromine in tetrachloromethane (04marks)

(ii) hydrogen chloride gas (04marks)

(e) Using equations only show how Y can be converted to benzenzaldehyde. (02marks).

7. Explain each of the following observations

(a) When hydrogen peroxide was added to lead(II) sulphide , black solid turned white. (04marks)

(b) Beryllium oxide is insoluble in nitric acid but soluble in sodium hydroxide solution. (04mark)

(c) Carbonic acid (H_2CO_3) and sulphurous acid (H_2SO_3) are both weak acid but they exhibit different bond angles. (04marks)

(d) When ammonia solution was added to nickel(II) sulphate solution , green precipitate was formed which dissolved to form a blue solution. (04marks)

(e) When methanoic acid was warmed with Fehling's solution a red precipitate was formed whereas with ethanoic acid , there was no observable change. (04marks)

8. (a) Soap can be prepared from a vegetable oil or animal fat.

(i) Distinguish between a vegetable oil and animal fat. (02marks)

(ii) Briefly plain how vegetable oil can be extracted from a natural source. (03marks)

(b) (i) Briefly describe how soap can be prepared from a vegetable

oil. State the chemical principles involved. (3½marks)

(ii) Write equation for the reaction leading to the formation of soap.

(01mark)

(iii) State one advantage and one disadvantage of using soap.

(i) Briefly explain he cleansing action of soap. (2½marks)

(ii) Explain why an aqueous solution of soap is alkaline.

(02mrks)

(c) (i) Distinguish between soap and non- soapy detergent .

(02mark)

(ii) Starting from duodecan- 1- ol write equations to show how you would prepare a detergent. (02marks)

(i) State one advantage and one disadvantage of using a detergent in washing. (02mark)

END