Name .... U0025/   Combination

KCB

Uganda Advanced Certificate Examinations

Mock 2019

Chemistry P525/2

Time allowed: 2houirs 30 minutes Date 21ST MAY, 2019(7.30-10.00pm)

Instructions

Answer **all** questions in section A and any **six** questions in section B

Illustrate your answers fully with appropriate diagrams and equations.

Your answers should be very clear and neat.

Where necessary, assume the following constants;

Avogadro's number = 6.02x 10^{23}

Universal gas constant = 8.314J/K/mol

Atmospheric pressure is 101325Nm^{-2}

Faradays constant = 96500C.

SECTION A Answer any three questions from this section

1. (a) Explain what is meant by the following terms
   (i) molar conductivity   (2 marks)

   (ii) Cell constant   (2 marks)

   (b)A conductivity cell filled with 0**.**1M aqueous potassium chloride solution gave a resistance at 25°C of 484.0Ω

   (i) Calculate the cell constant given that the molar conductivity of this solution is

$129.0\Omega^{-1}\ cm^2\ mol^{-1}$ (4 marks)

(ii) Explain how the temperature can affect the cell constant of a cell. (3 marks)

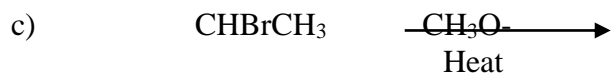(c) The following data were obtained for aqueous solutions of sodium iodide at 25°C.

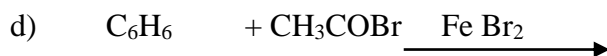| Concentration / moldm^{-3}	Molar conductivity/$\Omega cm^2\ mol^{-1}$
0.0005	125.15
0.0010	122.80
0.0027	124.35
0.0050	121.25

(i)   Draw a suitable graph and use it to determine the molar conductivity of infinite dilution for sodium iodide at 25°C. (5 marks)

(ii)

(iii)   Explain the shape of the graph in (c) (i) (4 marks)

2   Copy and complete the following equations and outline the plausible mechanism leading to the major product.

a) $COCH_3 + NH_2CONHNH_2 \xrightarrow{\ \ H+\ \ }$

b) $(CH_3CH_2)_3COH \xrightarrow[\text{heat}]{\text{Conc } H_3PO_4}$

c) $CHBrCH_3 \xrightarrow[\text{Heat}]{CH_3O^-}$

d) C_6H_6 $+ CH_3COBr$ $\underrightarrow{Fe\ Br_2}$

3 a)   Explain the principles of solvent extraction.   (5marks)

b)   During an experiment, ammonia was partitioned between aqueous 0.025M copper (II) sulphate solution and trichloromethane . The concentrations of ammonia in the aqueous and trichloromethane layers were 0.075M and 0.021M respectively. The partition coefficient for ammonia between the aqueous and trichloro methane mixture is 23.

i)   Determine the molar concentration of free ammonia in aqueous solution at equilibrium.   (3marks)
ii)   State three assumptions made.   (1½marks)
iii)   Determine the formula of complex of copper (II) ions in the aqueous solution.
                                                                                        (2½marks)
iv)   Write equation leading to formation of complex ion between copper (II) ions and ammonia.   (1mark)

c) A solution containing 12g of X in 60 cm^3 of water was extracted with 30 cm^3 of ether. If the distribution constant for X between water and ether is 0.2; calculate:

i)   Mass of X extracted in ether.   (3marks)
ii)   Total mass of X extracted if the solution of X above was extracted successively twice with 15cm^3 of ether instead.   (4marks)

4   The atomic numbers and melting points of the oxides of period 3 elements are shown in the Table below.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic number	11	12	13	14	15	16	17
Oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	Cl_2O_7
Melting point oC	1275	2827	2007	1607	560	30	-91

a) i) Plot a graph of melting points of oxides against atomic number of elements.
         (4mks)

ii)Explain the shape of the graph.   (6½ marks)

b) Write equation to show the reaction between,

      i)   Water and P_2O_5 (1½ marks)

      ii)   Sodium hydroxide and

                     Al_2O_3 (2½marks)

                     SiO_2 (2½ marks)

                     SO_3 (1½ marks)

      iii)   Hydrochloric acid and Al_2O_3 (1½marks)

SECTION B: Answer any two questions from this section

5   Nitrogen (II) oxide combines with oxygen at 80^oC and 200 atmospheres to form nitrogen (IV) oxide according to the following equation

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g), \Delta H = -x \text{ kJmol}^{-1}$$

(a) (i) Write an expression for the equilibrium constant k_p, for the reaction.   *(01 mark)*

(ii) Calculate k_p, if the mixture contained 67% nitrogen (IV) oxide at equilibrium *(3 ½ marks)*

(b) State how the value of k_p will be affected if

    (i)   Temperature is increased   *(01 mark)*

    (ii)   A catalyst is added   *(½ mark)*

(c) The kinetic data for the reaction in (a) is shown in the table below

Initial rate/ $Nm^{-2}s^{-1}$	6.8	27.2	61.2	108
P^2_{NO}/N^2m^{-4}	0.04	0.16	0.36	0.64

    P_{NO} = partial pressure of NO

    (i) Plot a graph of initial rate against P^2_{NO} *(03 marks)*

    (ii) Using the graph, determine the order of the reaction .

6 Using equations only, show how the following inter conversions of compounds can be carried out in the laboratory.

a) Ethanol to methylpropanoate.

b) Butane-1,4-dioic acid from bromoethane.

c) $NHCH_3$ from benzene.

d) $(CH_3)_2COHCH_2CH_3$ from 1-chloropropane.

e) Nylon-6,6 from cyclohexene

7 a) Solutions of miscible liquids are either ideal or non ideal.

     i) Explain the term ideal solution. (2marks)

     ii) Describe what causes solutions of miscible liquids to behave non ideally.

                           (4mks)

b) Water (boiling point 100°C) and methanol (boiling point 65°C) form an ideal solution when mixed.

     i) Draw a labeled vapour pressure-composition diagram for mixture of water and methanol. (2½marks)

     ii) Describe how pure methanol can be recovered from a mixture containing 60% water. (5 marks)

c) A mixture containing 2-nitrophenol and 4-nitrophenol was steam distilled at 76cmHg pressure.

     i) Name the compound that distilled over and explain your answer. (3½marks)

     ii) If the saturated vapour pressure of water at the boiling point of the mixture was 73cmHg, calculate percentage of water in distillate collected. (3marks)

8   a)   Outline the reactions that take place during the extraction of iron from spathic iron ore, $FeCO_3$.   (8marks)

     b)   Briefly describe how iron reacts with the following. Your answer should include equations.

          i)   Water.

          ii)   Chlorine.

          iii)   Dilute sulphuric acid.

          iv)   Concentrated sulphuric acid.

<u>END | SUCCESS</u>