Name .................................................................................... U0025/ Combination

**Kibuli Sec School**

**Uganda Advanced Certificate Examinations**

**Mock 2016**

**Chemistry P525/2**

**Time allowed: 2houirs 30 minutes Date 24th June, 2016 (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 1023

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 25oC of 484.0Ω

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

129**.**0Ω − 1 cm2 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 25oC.

|  |  |
| --- | --- |
| Concentration / moldm– 3 | Molar conductivity/Ωcm2 mol – 1 |
| 0**.**0005  0**.**0010  0**.**0027  0**.**0050 | 125**.**15  122**.**80  124**.**35  121**.**25 |

1. Draw a suitable graph and use it to determine the molar conductivity of infinite dilution for sodium iodide at 25oC. (5 marks)
2. 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) COCH3 + NH2CONHNH2 H+

b) (CH3CH2)3COH Conc H3PO4

heat

c) CHBrCH3 CH3O-

Heat

d) C6H6 + CH3COBr Fe Br2

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.

1. Determine the molar concentration of free ammonia in aqueous solution at equilibrium. (3marks)
2. State three assumptions made. (1½marks)
3. 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 cm3 of water was extracted with 30 cm3 of ether. If the distribution constant for X between water and ether is 0.2; calculate:

1. Mass of X extracted in ether. (3marks)
2. Total mass of X extracted if the solution of X above was extracted successively twice with 15cm3 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 | Na2O | MgO | Al2O3 | SiO2 | P2O5 | SO3 | Cl2O7 |
| Melting point oC | 1275 | 2827 | 2007 | 1607 | 560 | 30 | -91 |

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

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

1. Write equation to show the reaction between,
2. Water and P2O5 (1½ marks)
3. Sodium hydroxide and

Al2O3 (2½marks)

SiO2 ( 2½ marks)

SO3 (1½ marks)

1. Hydrochloric acid and Al2O3 (1½marks)

**SECTION B: Answer any two questions from this section**

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

2NO(g) + O2(g) 2NO2(g), ΔH = -*x* kJmol-1

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

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

1. State how the value of kp will be affected if
2. Temperature is increased *(01 mark)*
3. A catalyst is added *( ½ mark)*
4. The kinetic data for the reaction in (a) is shown in the table below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial rate/ Nm-2s-1 | 6.8 | 27.2 | 61.2 | 108 |
| P2NO/N2m-4 | 0.04 | 0.16 | 0.36 | 0.64 |

PNO = partial pressure of NO

(i) Plot a graph of initial rate against P2NO *(03 marks)*

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

1. Using equations only, show how the following inter conversions of compounds can be carried out in the laboratory.
2. Ethanol to methylpropanoate.
3. Butane-1,4-dioic acid from bromoethane.
4. NHCH3 from benzene.
5. (CH3)2COHCH2CH3 from 1-chloropropane.
6. 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 100oC) and methanol (boiling point 65oC) 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.

1. Name the compound that distilled over and explain your answer. (3½marks)
2. 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, FeCO3. (8marks)

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

i) Water.

ii) Chlorine.

iii) Dilute sulphuric acid.

1. Concentrated sulphuric acid.

END | SUCCESS