Name ..... U0025/ Combination

KCB

Uganda Advanced Certificate Examinations

Mock 2019

Chemistry P525/1

Time allowed: 2houirs 45 minutes Date 21st May, 2019 (2-4.45pm)

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 = 6.02×10^{23}

Universal gas constant = 8.314J/K/mol

Atmospheric pressure is $101325 Nm^{-2}$

Faradays constant = 96500C.

For examiners use only

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
M																		

Section A: Answer **all** questions in this section

1 (a) (i) The decay law is given the expression

$$-\frac{dN}{dt} = \lambda N$$

State what the symbols represent. (01½ marks)

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(ii) Using the above expression derive the expression for the relation between half life and the decay constant. (02 marks)

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(b) (i) Nickel(^{63}Ni) decays to copper (^{63}Cu)

Name the particle emitted and write the equation for the reaction:

Name of particle; (01mark)

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Equation

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(ii) Calculate the time taken for $\frac{15}{16}$ of nickel to be change to copper.

[The half life for nickel is 120 years] (02 marks)

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2 The following experimental results were obtained for the reaction

A + 2B $\longrightarrow$ products

Exp	Initial concentrations (mol $\lfloor^{-1}$)		Initial rate (mol $\lfloor^{-1} S^{-1}$)
	A	B	
1	3.0×10^{-2}	3.0×10^{-2}	2.7×10^{-5}
2	3.0×10^{-2}	6.0×10^{-2}	5.4×10^{-5}
3	6.0×10^{-2}	3.0×10^{-2}	10.8×10^{-5}

(a) (i) Deduce the order of reactions with respect to

[A];

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[B];

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(ii) Write the expression for the rate equation (0½ mark)

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(b) The rate of reaction under certain conditions for temperature and pressure is x. Express the rate in terms of x when the following changes are made.
(0 ½ mark each)

(i) The concentration B is halved while the concentration of A remains unchanged

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(ii) The rate constant is doubled, by increasing temperature, but keeping the concentrations of A and B unchanged.

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(iii) If 90% of B is removed by precipitation, without affecting concentration of A.

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(c) Calculate the value of the rate constant and state its units. (02 marks)

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3 Calculate the pH of a 0.1 moldm $^{-3}$ solution of aluminium nitrate

(Acid dissociation constant, Ka at 25^{o}C for $Al(H_2O)_6^{3+}$ is 1.4 x 10 $^{-5}$ moldm $^{-3}$) (5 marks)

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4 a) State three factors that can favour formation of complexes. (01 ½ marks)

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b) Determine the coordination number of the central species and name the following complexes.

Formula of complex	Coordination number	Name of complex
$[CrCl_2(H_2O)_4]^+$		
$[Ag(NH_3)_2^+$		
$[Fe(SCN)(H_2O)_5^{2+}$		

5 a) i) What is meant by the term ionization energy of an element (2marks)

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Write equation to show the first ionization energy of magnesium. (1 mark)

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b) The second and third ionization energies of magnesium are 1450 and 7730kJmol^{-1} respectively. Give a reason for the large difference between the second and third ionization energies of magnesium. (2marks)

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6 Name the product after completing the following equations.

a) $COCH_2CH_3 \xrightarrow[\text{Heat}]{H_2}$

Name ……..

b) $CHOHCH_3 \xrightarrow{I_2\ HO^-}$

Name…….

c) $C_2H_5OH \xrightarrow[140^oC]{\text{Conc } H_2SO_4}$

Name…….

7 Complete the equations and suggest the mechanism.

a) Methanal with hydroxyl amine

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b) Silver acetate with bromoethane

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8 Explain the following terms.

a) Addition polymerization.

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b) Condensation polymerization.

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c) Give an example of;

i) A natural addition polymer and identify its structure.

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ii) Synthetic condensation polymer and identify its structure.

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9 a) Explain the term eutectic mixture. (2marks)

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b) Solder is eutectic mixture of tin and lead.

i) State one use of solder. (1mark)

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ii) In an experiment to determine the percentage of tin in solder, a student dissolved 4.0g solder in nitric acid to make 1litre of solution. Every 25.0cm^3 portion of the

solution reacted completely with 15.5cm^3 of 0.01M iodine solution. Determine percentage of tin in solder. (r.a.m for tin is 118.7).
(2marks)

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SECTION B. Answer any **six** questions from this section

10. (a) Nitrogen reacts with hydrogen in a mole ratio of 1:3 to form ammonia.
Write;
(i) equation for the reaction that takes place. (01 ½)

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(ii) the expression for the equilibrium constant (Kc) (0 ½)

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(b) State the conditions used to obtain maximum yield of ammonia during it manufacture by the Habers process. (01½)

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(c) The percentage of ammonia in the equilibrium mixture of gases was found to be 15% at 600^{o}C.
Calculate the equilibrium constant (Kc) for the reaction at 600^{o}C. (04)

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(d) State what would happen to the equilibrium position of the reaction in a(i) above when hydrogen chloride gas is added to the equilibrium mixture. Give a reason for your answer. (01½)

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11 a) State the chemical nature of the following;

i) Soap.

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ii) Fat.

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b) Identify any two differences between a fat and oil.

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c) Explain how scum formation is a disadvantage in use of soap.

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d) Identify the monomer(s) , give the name(s) of monomer(s) identified and type of polymerization process that formed it.

polymer	Monomer(s)	Type of polymerization
$(HN(CH_2)_6NHCO(CH_2)_8CO)_n$		
$(CH_2C(CN)CH_2(CN)CH_2C(CN))_n$		

12 Name the reagent(s) that can be used to distinguish between the given pairs of compounds and in each case state the observation made when each compound is treated with the named reagent(s).

a) $(CH_3)_2CO$ and $(CH_3)_2O$

Reagent(s)……
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Observation

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b) CO and CHO

Br

Reagent(s)

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Observation

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c) C_6H_4BrOH and $C_6H_{11}ClOH$

Reagent(s)

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Observation

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13 a) Write equation and state the conditions for thr reaction leading to the formation of;

i) Tin (II) chloride. (2½ marks)

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ii) Tin (IV) chloride. (3 marks)

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b) Tin (II) chloride and tin (IV) chloride were separately exposed to air.

i) State what was observed in each case. (1mark)

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ii) Write the equation(s) for the reaction(s) that took place. (1½ marks)

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c) Write equation for the reaction between tin (II) chloride and iron (III) chloride solution. (1½ marks)

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14 a) Explain the term relative atomic mass. (2marks)

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b) Explain how ions of different charge to mass ratios can be focused on the detector in the mass spectrometer. (2marks)

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c) Copper consists of two isotopes, Cu-64 and Cu-65 in intensity ratios of 4:1.

i) Explain the term intensity. (1 mark)

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ii) Name the most abundant isotope of copper and give reason for the answer. (½ marks)

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iii) Determine the relative atomic mass of copper. (2marks)

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iv) State three advantages about this data. (1½marks)

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15 a) i) Explain the term ideal gas. (1mark)

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ii) State four characteristics of and ideal gas. (2marks)

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b) The graph shown below shows behavior of gases. Use it to answer the questions after it.

Explain the shape for: (2marks)

i) Helium.

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ii) Nitrogen gas.

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c) The isotherms for carbon dioxide are shown below.

i) State the critical temperature for the gas. (1mark)

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ii) Explain the term critical temperature of gas. (1mark)

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16 a) When 2.0g of X was dissolved in 100.0g of water, the solution froze at -0.1°C. If the molal freezing constant for water is 1.8°C/mol/kg;

Deduce molar mass of X. (2marks)

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b) When 2g of X was dissolved in 1000cm^3 of hexane, the solution exerted an osmotic pressure of 40Pa.

i) Determine the molar mass using this data. (1mark)

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i) Explain differences in the two molar masses. (1mark)

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c) An aqueous solution containing 2.8g/litre of R exerts an osmotic pressure of 380 mmHg at standard temperature and pressure. Calculate the molar mass of R .
(2marks)

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d) When 3.4g of R was burnt in excess oxygen, 5.04 litres of carbon dioxide and 2.7g of water formed.

i) Calculate the empirical formula of R. Molar gas volume is 22.4 litres
(2marks)

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ii) Deduce molecular formula of R. (1mark)

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END Success