KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
SUPPLIMATARY EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 101

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY II

DURATION: 2 HOURS

DATE: 16/10/2018 **TIME: 3:00-5:00PM**

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **5** printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

Important information; (R: 8.314Jk^{-1}= 0.0821L atm mol^{-1}k^{-1}, 1 atm 101325NM^{-2} =101325Pa =760mmHg)

Question one (30 marks)

a) The van der waals equation of state expressed as

$$(P + \frac{n^2a}{V^2})(V - nb) = nRT$$

i) State the meaning of each of the following terms: P, V, n, R and T **[05]**

b) Write an expression for the law of mass action for the Haber process reaction **[04]**

(b) A sample of oxygen gas at 25°C is compressed from 200 cm^3 to 0.240 cm^3. Its pressure is now 3.00 mm Hg. What was the original pressure of the oxygen? **[03]**

(c) When 0.08 moles CO, 0.14 moles of H_2, and 0.08 moles of CH_4 are placed in a 1-L vessel at temperature *T* and allowed to come to equilibrium. The mixture is found to contain 0.01 moles H_2O for the reaction:

$$CO\ (g) + 3\ H_2\ (g) \rightarrow\ CH_4\ (g) + H_2O\ (g)$$

What is the equilibrium constant, *K*?

[04]

(d A buffer solution was made by adding 3.28g of Sodium Ethanoate to 1dm^3 of 0.01 mol dm^{-3} ethanoic acid. What is the PH of the buffer solution? Calculate the change in pH of this buffer when 1cm^3 of NaOH was added to it. Comment on the result. K_a (CH_3COOH) = 1.7 x 10^{-5} $moldm^3$. **[03]**

e) Calculate, using the ideal gas equation and the van der Waals equation the pressure exerted by 1.00 mole of CO_2 at 0°C in a 22.4 L container. Assuming that the gas in (i) above is compressed so that it fills a container that has a volume of only 0.200 liters. Calculate, using the ideal gas equation and Van der Waals equation the new pressure. (a =3.597atm/moL and b=0.04267atm/mol) **[04]**

f) How is a buffer solution prepared? **[02]**

j) State Faraday's first laws of electrolysis. **[02]**

k) What do you understand by the term electrolyte? **[01]**

l) Write the expression of the Nernst equation that relates the instantaneous electrode potential to the reaction quotient. **[02]**

Question Two (20 marks)

a).

i. What is solubility of a salt? **[01]**

ii. The solubility for silver bromide is 8.8x10-7 M. Determine its solubility product, Ksp. **[02]**

b). Explain the following types of Physical Equilibria **[03]**

i. Solid – Liquid Equilibrium

ii. liquid – Liquid Equilibrium

c). What is the concentration of a saturated lead chloride solution? K_{sp} ($PbCl_2$) = 1.17×10^{-5}. **[03]**

d). A new chemical compound has been discovered with the formula A_2B. If a saturated solution of A_2B has a concentration of 4.35×10^{-4} M, what is the solubility product constant for A_2B? **[03]**

(e)A certain malt liquor contains 7% ethanol (C_2H_5OH) by mass. Calculate the mole fraction, the molarity and the molality **[04]**

f). Give four Colligative properties **[04]**

Question Three (20 marks)

(a) When 4.50 g of ethyl butyrate, a compound containing C,H, and O, undergoes combustion, 10.24 g of CO_2 and 4.19 g H_2O are produced.

Determine the empirical formula of this compound **[04]**

(b) i). State and the factors that influence equilibrium concentrations **[06]**

ii). Explain the effect of common ion on solubility. **[02]**

d. Lead chloride at first precipitates when sodium chloride is added to a solution of lead nitrate. Later, when the solution is made more concentrated in chloride ion, the precipitate dissolves. (Note the lead ion forms the complex ion $PbCl_4^{2-}$). Explain what is happening. **[04]**

e). You are asked to analyze a solution for the cations Zn^{2+}, Ag^{+}, and Ba^{2+}. You add hydrochloric acid. A precipitate forms. You filter out this solid and add sulfuric acid to the solution. A white precipitate forms. You filter out this solid also, and then add hydrogen sulfide to the solution. Nothing appears to happen. Which cations were present in the original solution? **[04]**

Question Four (20 marks)

a) Describe experiments to demonstrate the products formed in the electrolysis sulphuric acid using carbon electrodes. **[03]**

b) An element X has r.a.m of 88. When a current of 0.5A was passed through the fused chloride of X for 32minutes and 10 seconds, 0.44g of X was deposited at the cathode. (Use 1 Farad = 96,500 coulombs)

i. Calculate the quantity of electicity needed to liberate one mole of X. **[04]**

ii. Write the formular for the cation of X. **[01]**

iii. Write formular for the chloride of X. **[01]**

c)

i) For a galvanic cell combining Zn and Cu, calculate the standard cell potential E° (given standard reduction potential for Zn^{2+} is -0.76V and that for Cu^{2+} is +0.34V) **[03]**

ii) Calculate the cell potential for the Zn//Cu cell at $[Zn^{2+}_{(aq)}] = 10M$ and $[Cu^{2+}_{(aq)}] = 0.1M$ **[03]**

d) The oxidation and reduction half cell reactions of the following overall process exist in separate half cells.

$$Cr_2O_7^{2-}{}_{(aq)} + I^-_{(aq)} \longrightarrow Cr^{3+}_{(aq)} + I_{2(s)} \quad E° = 0.8254V.$$

Given the stoichiometric equation is,

$$Cr_2O_7^{2-}{}_{(aq)} + 6\ I^-_{(aq)}\ 14H^+_{(aq)} \longrightarrow Cr^{3+}_{(aq)} + 3\ I_{2(s)} + 7H_2O_{(l)}$$

and the different concentrations are tabulated

Species	Concentration
$Cr^{3+}_{(aq)}$	2.0×10^{-3}
$Cr_2O_7^{2-}{}_{(aq)}$	2.0
$H^+_{(aq)}$	1.0
$I^-_{(aq)}$	1.0

Calculate the instantenoues cell potential for the cell. **[05]**

Question five (20 marks)

a) Define the following terms;

i) Phase Equilibrium: **[02]**

ii) Binary Isomorphous Systems: **[02]**

iii) Binary Eutectic Systems: **[02]**

iv) Component of a system: **[02]**

v) Solubility Limit: **[02]**

b) Draw a schematic representation of the one-component phase diagram for H_2O. The projection of the phase diagram to show information at 1 atm generating a temperature scale labeled with the familiar transformation temperatures for H_2O (melting at 0°C and boiling at 100°C). **[10]**