350

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS 2015/2016
FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE
FIRST YEAR SECOND SEMESTER
(Main Examination)

COURSE CODE: SCH 101
COURSE TITLE: FUNDAMENTALS OF CHEMISTRY II
TIME: 2 HOURS TIME: 8-10AM **DATE 10/5/2016.**

INSTRUCTIONS TO CANDIDATES

This paper consists of FIVE questions. Answer question ONE which is COMPULSORY (30 marks) and any other TWO questions (20 marks each)

1a) Define the term pH. **(1 mk)**

b) Calculate the PH of the following solutions:

i. Nitric acid whose concentration is 2.4×10^{-3} M **(3 mks)**

ii. Sulphuric acid solution whose concentration is 2.4×10^{-3} M **(3 mks)**

iii. Sodium hydroxide solution whose concentration is 2.4×10^{-3} **(3 mks)**

c) State four factors that influence range in which an indicator changes colour. **(4 mks)**

d) What is a buffer solution? **(1 mk)**

e) How is a buffer solution prepared? **(2 mks)**

f) 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) = 1.7×10^{-5} $moldm^3$) **(9 mks)**

g) Explain TWO applications of buffer solutions **(4mks).**

2 a) i) what is a colligative property of a solution. **(1mk).**

ii) State four important **colligative** properties of a solution. **(4mks).**

(b) The vapour pressure of water at 293 k is $2333NM^{-2}$. When 100g of sucrose are dissolved in 1000g of water, the vapour pressure is lowered by $12.28NM^{-2}$.

i. What is vapour pressure. **(1mks).**

ii. calculate the molecular mass of sucrose. (H=1, O=16). **(3mks)**

c) State Raoult's law **(1mk)**

d) Explain the difference between ideal and non-ideal solutions. **(2mks)**

e) Ethyl acetate and ethyl propionate form nearly ideal solutions over the entire range of compositions. At 20°C vapour pressure of ethyl acetate is 72.8mmhg and ethyl propionate is 27.7mmhg. Calculate;

i. The vapour pressure of a liquid mixture containing 25g of ethyl acetate and 50g of ethyl propionate. (molecular mass; ethyl acetate=88, ethyl propionate=102) **(6mks)**

ii. The mole fraction of each in the vapour phase. **(2mks)**

3.

a. State Le Chatellier's principle. **(1mk).**

b. What is meant by dynamic equilibrium of reversible reactions. **(1mk)**

c. State any four factors affecting dynamic equilibrium. **(4mks)**

d. At 900K, the reaction between SO_2 and O_2 gives the product as SO_3 and has K_p of 0.345. In the equilibrium mixture, the partial pressure of SO_2 and O_2 are 0.215 and 0.679 respectively. Calculate the equilibrium partial pressure of SO_3. **(5mks).**

e. Given the equilibrium equation;

$$H_{2(g)} + I_{2(g)} \longrightarrow 2\,HI_{(g)}$$

Calculate the equilibrium concentrations of the gaseous mixture given that initially $[H_2] = [I_2] = 0.200M$ and $K_c = 64.0$. **(6mks)**

f) State three factors affecting solubility of a salt **(3mks)**

4.a) State three assumptions of kinetic theory of gases. **(3mks)**

b) State Charles law **(1 mk)**

c) A fixed mass of gas has a volume of $76cm^3$ at 27°C and 100kPa pressure. Determine the volume that the gas would occupy at stp.(Take stp values as 0°C and 101.3 kPa)**(3mks)**

d) Outline THREE difference between real gases and perfect gases? **(3mks)**

e) Calculate the pressure at which two moles of ammonia would be expected to have just one litre of volume when its temperature is 27°C using;

i. ideal gas equation **(3mks)**

ii. Van der Waals equation (where $a = 4.17atm.\ dm^6\ mol^{-2}$, $b = 0.0371dm^3\ mol^{-1}$, R = 0.082 atm L mol^{-1} K^{-1}) **(4mks)**

f) A typical energy difference between the ground state and the first excited energy level is about 300kJ/mol at 25°C. Using **Boltzman's distribution**, calculate the ratio of the number of molecules in the first energy (N_1) in relation to the number of molecules in the ground state (N_o) **(3mks)**

5(a) Distinguish between empirical formula and Molecular formula of a compound. **(2 mks)**

b) An organic compound contains 31.9% by mass carbon, 6.8% hydrogen, 18.5% Nitrogen and the rest being oxygen. It has vapour density of 37.5. Calculate the molecular formula of the compound. (C = 12.0, N = 14.0, H = 1.0, O = 16.0) **(5 mks)**

c) If 0.5g of impure Copper (II) Oxide reacted with $50cm^3$ of 0.1M Nitric Acid. Calculate the percentage of Copper (II) Oxide in the impure sample, assuming that the impurities did not react with the acid. (Cu = 63.5, 0 = 16.0, N = 14.0, H = 1.0) **(4 mks)**

d)(i)Define 'oxidation' in terms of electron transfer. **(1mk)**

(ii)Determine the oxidation number of Chromium in $Cr_2O_7^{2-}$ **(2mks)**

the cell is 0.35 V and the concentration of $Cu^{2+}(aq)$ is 3.5 M and the reduction potentials for the two half cells are ;

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ $E° = +0.34$ V

$Ag^+(aq) + e^- \longrightarrow Ag(s)$ $E° = +0.80$ V

I) write the overall cell reaction **(1mk)**

II) calculate;

i. the standard cell potential, E°, of the cell **(2mks)**

ii. the concentration of $Ag^+(aq)$ at 25°C, using *Nernst equation*. (F = 96500C, R= 8.314 J $K^{-1}mol^{-1}$). **(3mks)**