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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 101

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY II

DURATION: 2 HOURS

DATE:6/8/2018 TIME: 9-11AM

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)

1 (a) state the following gas laws (2mrks)

(i) Charles Law.

(ii) Gay-Lussac'c Law.

(b) A sample of a gas at 27 °C is compressed form 300 cm^3 to 60 cm^3. Its pressure is now 3.00 mm Hg. What was the original pressure of the gas? (3mks)

(c) State two application of the buffers solution(2mks)

(d) (i) Explain the difference in the terms Molarity and Molality (2mks)

(ii) Write an equation to show how the mole fraction of a component can be expressed(2mks)

(e) (i) Given the following general equation write an expression to show how one can get the equilibrium constant K_c . (2mks)

$aA+bB \Leftrightarrow cC + dD$

(ii) In an experiment, a mixture of H_2, N_2 and NH_3 was allowed to reach equilibrium conditions at 473 °C. The concentration of the gases at equilibrium was analyzed and found to contain 0.1207 M H_2, 0.0402 M N_2 and 0.00272 M NH_3. What was the value of the equilibrium constant Kc? (3mks)

(g) Find the pH of a solution that contains 0.0034 lactic acid ($Ka=1.4x10^{-4}$) and 0.056 M Propanoic acid ($Ka=1.4x10^{-5}$) (3mks)

(h) Solubility product constants are usually specified for 25 °C. why does the Ksp value for a chemical compound depend on the temperature (3mks)

(i)One form of the Nernst equation is

$$E = E^{O} - \frac{2.303 \times RT}{nF} \log Q$$

(i) Write the meaning of the terms in the equation(4mks)

(ii) How would increase in concentration change the E.M.F of the cell if all the other conditions are kept constant?(2mks)

Question 2 (20 marks

2 (a) Define the following terms (6mks)

(i) Mole

(ii) Atomic mass

(iii) Molar mass

(b) Iron can react with chlorine gas to give two different compounds, $FeCl_2$ and $FeCl_3$. Under given conditions, 0.558 grams of metallic Fe react with chlorine gas to yield 1.621 grams of iron chloride. Which iron compound is produced in this experiment? [Fe=55.85, Cl=70.90] (5mks)

(c) Lysine is an amino acid which has the following elemental composition: C, H, O, and N. In an experiment 2.175 g of Lysine was combusted to produce 3.94 g of CO_2 and 1.89 g H_2O. In a separate experiment, 1.873 g of Lysine was burned to produce 0.436 of NH_3. The molar mass of Lysine is approximately 150 g/mol. Determine the empirical and molecular formula of Lysine. (5mks)

(d) A compound A contains 5.2 % by mass of nitrogen as well as C, H and O. Combustion of 0.0850 g of compound A gave 0.224 of CO_2 and 0.0372 g of H_2O. Calculate the empirical formula of A. (4 mks)

Question 3 (20 marks

3 (a) (i) State Dalton's Law of Partial pressures (2mks)

(ii) What pressure is exerted by a mixture of 2.00 g of H_2 and 8.00 g of N_2 at 273 K in a 10 litre vessel? (5mks)

(b)A hydrogen gas thermometer is found to have a volume of 100.0 cm^3 when placed in an ice-water bath at 0 °C. When the same thermometer is immersed in boiling liquid chlorine, the volume of hydrogen at the same pressure is found to be 87.2 cm^3. What is the temperature of the boiling point of chlorine? (4mks)

(c) (i) Calculate the pressure exerted by 1.00 mole of methane (CH_4) in 250 ml container

at 300 K using van der waal's equation. What pressure will be predicted by the ideal gas equation? (6mks)

(d) Calculate how much faster He will diffuse than Oxygen at 298 K? [He=2 O=16](3mks)

Question 4 (20 marks

4 (a) (i) What is solubility (2mks)

(ii) Briefly explain the effect of temperature on the solubility of solids in solutes (2mks)

(b) (i)State Raoult's law(2mks)

(ii) The vapour pressure of water at 20° C is 17.5 torr. If sucrose is added to a mole fraction of 20 % what is the resulting vapour pressure of H_2O (3mks)

c)(i) What is corrosion of Iron? (2mks)

(ii) Using a diagram, show how cathodic protection works in prevention of corrosion of iron (3mks)

(d) Consider the voltanic cell

$$Cd_{(s)}/Cd^{2+}{}_{aq}//Ni^{2+}{}_{(aq)}/Ni_{(s)}$$

(i) Write the half-cell reactions and the overall reaction (3mks)

(ii) Make a sketch of this cell and label it showing the anode, cathode and direction of electron flow (3mks)

Question 5 (20 marks

5 (a) The solubility for silver bromide is $8.8x10^{-7}$ M. Determine its solubility product Ksp (3mks)

(b) What is the concentration of a saturated silver I acetate solution Ksp

$(AgC_2H_3O_2) = 1.94x10^{-3}$ (3mks)

(c) What is the concentration of a saturated lead chloride, Ksp $(PbCl_2) = 1.17x10^{-5}$ (3mks)

(d) I have discovered a new chemical compound with the formula A_2B. If a saturated solution of A_2B has a concentration of $4.35x10^{-4}$ M, what is the solubility product constant for A_2B.(3mks)

(e) Solubility product constants are usually specified for 25 °C. Why does the Ksp value for a chemical compound depend on the temperature?(3mks)

(f) a) The van der waals equation of state expressed as

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

i) State the meaning of each of the following terms: P, V, n, R and T (3mks)