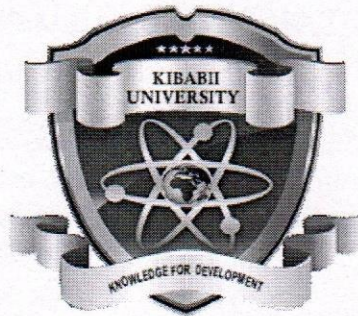


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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR**

FIRST YEAR SECOND SEMESTER

SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 101

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY II

DURATION: 2 HOURS

DATE: 26TH SEPTEMBER 2017 TIME: 3 – 5PM

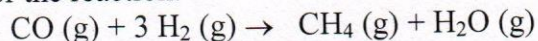
INSTRUCTIONS TO CANDIDATES

This paper consists of **FIVE** questions. Answer question **ONE** which is **COMPULSORY**(30 marks) and any other **TWO** questions from questions two, three, four and five (**20 marks each**)

QUESTION ONE (30 MARKS)

1.

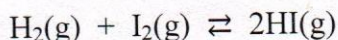
a) When 0.08 moles CO, 0.14 moles of H₂, and 0.08 moles of CH₄ are placed in a 1-L vessel at temperature *T* and allowed to come to equilibrium. The mixture is found to contain 0.01 moles H₂O for the reaction:



What is the equilibrium constant, *K*?

[04]

b) 1.000 mole of H₂ gas and 1.000 mole of I₂ vapor are introduced into a 5.00-liter sealed flask. The mixture is heated to a certain temperature and the following reaction occurs until equilibrium is established.



At equilibrium, the mixture is found to contain 1.580 mole of HI.

i. What are the concentrations of H₂, I₂ and HI at equilibrium?

[03]

ii. Calculate the equilibrium constant *K_c*.

[02]

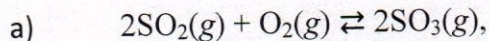
c) State the *Le Châtelier's principle*.

[01]

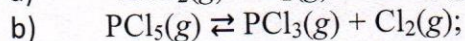
d) State three factors that influence equilibrium:

[03]

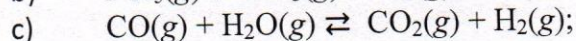
e) Consider the reactions below. Explain how increase in pressure would affect the direction of the reaction.



[02]



[02]



[02]

f) State Raoult's law.

[01]

g) What is the vapor pressure of the pure solvent if the vapor pressure of a solution of 10 g of sucrose (C₆H₁₂O₆) in 100 g of ethanol (C₂H₆O) is 55 mmHg? [04]

h) Calculate osmotic pressure for 0.10 M Na₃PO₄ at 20°C.

[02]

i) Calculate molarity if solution in water (300 K) has osmotic pressure of 3.00 atm.

[02]

j) Hemoglobin is a large molecule that carries oxygen in human blood. A water solution that contains 0.263 g of hemoglobin (Hb) in 10.0 mL of solution has an osmotic pressure of 7.51 torr at 25°C. What is the molar mass of the hemoglobin?

[02]

QUESTION TWO (20 MARKS)

2. a) Air is primarily a mixture of nitrogen N_2 molecules (molecular mass 28.0u) and oxygen O_2 molecules (molecular mass 32.0u). Assume that each behaves as an ideal gas and determine the rms speeds of the nitrogen and oxygen molecules when the temperature of the air is 293K.

[05]

b) Calculate the pressure exerted by 84.0 g of ammonia, NH_3 , in a 5.00 L container at 200. °C using the van der Waal's equation. The van der Waal's constants for ammonia are: $a = 4.17 \text{ atm L}^2 \text{ mol}^{-2}$ $b = 3.71 \times 10^{-2} \text{ L mol}^{-1}$

[05]

- c) If sulfur dioxide were an "ideal" gas, the pressure at 0°C exerted by 1.000 mol occupying 22.41 L would be 1.000 atm. Use the van der Waals equation to estimate the "real" pressure. ($a = 6.865 \text{ L}^2 \text{ atm/mol}^2$ and $b = 0.05679 \text{ L/mol}$) [05]
- d) What are the assumptions made for an ideal gas? [03]
- e) For gases; hydrogen, ammonia and chlorine state with reasons which gas is closest to ideal behavior at stp. [02]

QUESTION THREE (20 MARKS)

2 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]

QUESTION FOUR (20 MARKS)

4

a) Define the term pH

[01]

b) Calculate the PH of the following solutions:

- i) 1.5M HF solution whose $K_a = 7.0 \times 10^{-4}$ [04]
ii) Sulphuric acid solution whose concentration is $2.4 \times 10^{-3} \text{ M}$ [03]
iii) Sodium hydroxide solution whose concentration is 2.4×10^{-3} [04]

c)

- i. What is a buffer solution [02]
- ii. How is buffer solution prepared? [02]
- iii. What is the pH of a solution of 0.400M formic acid in 1.000M sodium formate?

(Take $\text{H}_2\text{O} + \text{HCOOH} \leftrightarrow \text{H}_3\text{O}^+ + \text{HCOO}^-$ ($K_a = 1.80 \times 10^{-4}$) [04]

QUESTION FIVE (20 MARKS)

5

a) Differentiate by defining between empirical formula and molecular formula of a compound [02]

b) The percentage of copper in a sample was determined by dry ashing. The results obtained were tabulated as below.

Quantity	Mass (g)
Mass of empty porcelain boat	14.4
Mass of boat + copper oxide	18.4
Mass of boat + reduced copper	17.6

Use the information to determine the formula of the oxide of copper. (take $\text{Cu} = 63.5\text{gmol}^{-1}$ and $\text{O} = 16\text{gmol}^{-1}$) [06]

- c) A hydrocarbon has a percent composition by mass of 85.7% of carbon and the rest hydrogen. Determine the empirical formula of the hydrocarbon. If the molecular mass of the compound is 56. Calculate its molecular formula. [06]
- d) Discuss the sources of error during gravimetric analysis. [06]