



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

MASTERS OF SCIENCE IN CHEMISTRY

ACH 5107: ADVANCED ELECTROCHEMISTRY AND CHEMICAL KINETICS

SPECIAL/ SUPPLEMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 3HOURS

DATE: Pick Date Sep 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **SIX** Question(s). Attempt any **FOUR** questions.

Do not write on the question paper.

Question ONE

- a) Calculate the molecular weight of sulfur if 35.5 grams of sulfur dissolve in 100.0 grams of CS₂ to produce a solution that has a boiling point of 49.48°C. **(6 marks)**
- b) At 25°C, the specific volume of saturated liquid is 1.003 cm³/g and the volume of saturated vapor is 43400 cm³/g. What is the volume of a mixture with vapor fraction, x=0.3 **(8 marks)**
- c) i) Calculate the temperature of 20.0 mole of helium in a 10.0 litre cylinder at 120 atmosphere pressure. **(6 marks)**
- ii) Compare this value with the temperature calculated from the ideal gas equation. [Data - Van der Waals constants for helium: a = 0.0341 L² at mol⁻²; b = 0.0237 L mol⁻¹] **(5 marks)**

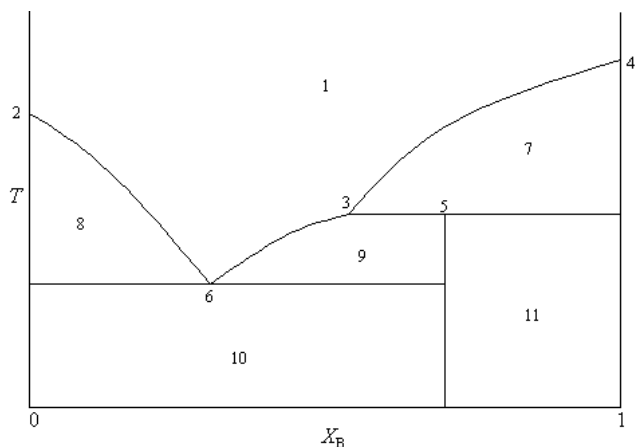
Question TWO

- a) Differentiate between mean activity and mean activity coefficient **(4 marks)**
- b) Discuss the colligative properties **(8 marks)**
- c) Calculate the solubility of Pb(IO₃)₂ in a solution of 0.020 M Mg(NO₃)₂. **(7 marks)**

- d) The vapor pressure of 1-propanol is 10.0 torr at 14.7 °C. Calculate the vapor pressure at 52.8 °C, if the heat of vaporization of 1-propanol = 47.2 kJ/mol (6 marks)

Question THREE

- a) Draw a fully labelled phase diagram of water (5 marks)
 b) Find the formula of the compound from the phase diagram shown below and label it (15 marks)



- c) In an experiment carried out, hydrogen iodide was found to be 22.3% dissociated at 730.8°K. Calculate K_c for $2 \text{ HI}(g) \rightarrow \text{H}_2(g) + \text{I}_2(g)$ (5 marks)

Question FOUR

- a) The latent heat of vaporization of water at 100°C is 539 kcal/kg. Calculate the boiling point of water at 600 mm Hg. The value of the universal gas constant is 1.98 cal/mole °K. (6 marks)
 b) i) Define colloids and (4 marks)
 ii) Describe the **four** types of colloids stating their dispersed phase and dispersing medium (8 marks)
 c) Explain the Tyndall effect (7 marks)

Question FIVE

- a) i) Differentiate between surface and interface (10 marks)
 ii) Discuss **three** examples applications of surfaces (9 marks)
 12. Calculate osmotic pressure of 5% solution of cane sugar (sucrose) at 15°C. $m = \text{mol. mass of sucrose (C}_{12}\text{H}_{22}\text{O}_{11}) = 342$ (6 marks)

Question SIX

- a) Explain the Gibbs phase rule **(4 marks)**
- b) Using the Gibbs phase rule calculate the degrees of freedom of water in all the three phases **(6 marks)**
- c) Calculate I for a solution that is 0.3 molal in KCl and 0.5 molal in $K_2Cr_2O_7$. **(7 marks)**
- d) Calculate the standard entropy of formation of H_2O (l), its standard Gibb's energy of formation, and the equilibrium constant K for the reaction. **(8 marks)**

