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 DateSep2018

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). Attemptany 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 CS_2 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 cm^3/g and the volume of saturated vapor is 43400 cm^3/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 L^2 at mol^{-2}; b = 0.0237 L mol^{-1}] **(5 marks)**
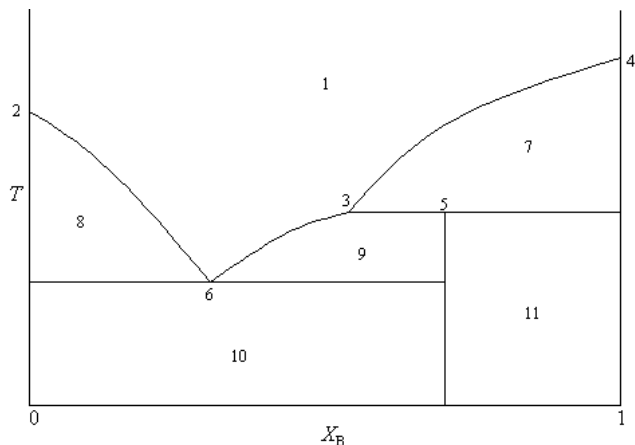
Question TWO

a) Differentiate between mean activity and mean activity coefficient **(4 marks)**

b) Discuss the colligative properties **(8 marks)**

c) Calculate the solubility of $Pb(IO_3)_2$ in a solution of 0.020 M $Mg(NO_3)_2$. **(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 $2\ HI(g) \rightarrow H_2(g) + I_2(g)$ **(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 = mol. mass of sucrose $(C_{12}H_{22}O_{11}) = 342$ **(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)**

$$H_2 (g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$$