(University of Choice)

MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)
MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE (ENGINEERING, PHYSICS, DISASTER PREPAREDNESS)

COURSE CODE: SCH 101

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY II
(SUPPLEMENTARY, SPECIAL EXAMINIATIONS)

**DATE:** 01. 08. 2022   **TIME: 8.00-10.00 AM**

INSTRUCTIONS TO CANDIDATES
➢ Answer **ALL** questions

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE (17 marks)

a)i) State the Charles law and explain the significance of -273°C   (3 marks)

ii) At 10° C the volume of a given gas is 500 cm^3. Calculate the volume the same gas would occupy at 24° C   (2 marks)

b i) State Dalton's law of partial pressures   (1 mark)

ii) 100 ml of oxygen at 1.75 atm and 200ml nitrogen at 0.6 atm are passed into a vessel whose capacity is 500ml. Calculate the total pressure of the mixture in the vessel at the same temperature   (3 marks)

c) At a given temperature and pressure, a certain amount of argon requires 30s to diffuse through a porous plug. How long will it take an equivalent amount of nitrogen to diffuse under the same conditions?   (3 marks)

f) The sketch below shows the distribution of particles at different temperatures according to Boltzmann-Maxwell approximations.
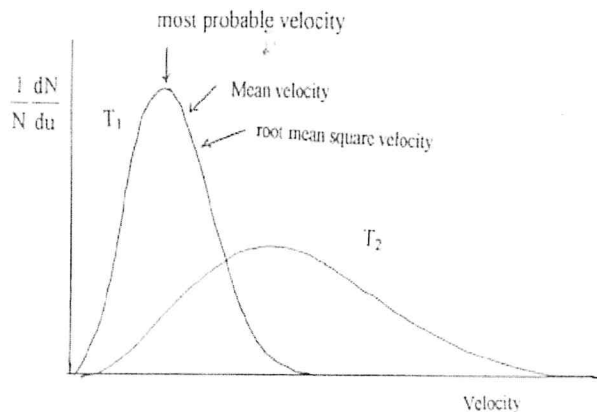
Briefly explain the nature of the 2 curves.   (2 marks)

g) Explain the difference between the ideal gas equation and the Van der Waals equation
(3 marks)

2

QUESTION TWO (17 marks)

a) Can the equilibrium $CaCO_3$ (s) $\rightleftharpoons$ CaO (s) + CO_2 (g) be attained in an open vessel? Why or why not? **(2 marks)**

b) The value of K_p for the equilibrium, $2H_2O(g) + 2Cl_2$ (g) $\rightleftharpoons 4$ HCl (g) + O_2 (g) is 0.035 atm at 400°C when the partial pressures are expressed in atmospheres. Calculate the value of K_c for the same reaction **(3 marks)**

c) How is it that a reversible reaction is spontaneous in the forward as well as backward direction? **(2 marks)**

d) Which of the properties remain constant when equilibrium is attained? **(2 marks)**

e) Will a solution of ammonium chloride in liquid ammonia be acidic? **(2 marks)**

f) HCOOH has the dissociation constant 2.1×10^{-4} at room temperature. Calculate the degree of dissociation and pH of 0.01 M solution of it. **(3 marks)**

g) Calculate the pH of a 0.05M solution of ammonium chloride. Dissociation constant of ammonium hydroxide is 1.8×10^{-5} **(3 marks)**

QUESTION THREE (18 marks)

a) Define solubility of a salt **(2 marks)**

b) The K_{SP} of CaF_2 is 1.7×10^{-10} $mol^{-3}l^{-3}$ at 25 °C. Calculate die solubility of CaF_2 in 1 litre of water **(3 marks)**

c) Tabulate the differences between an electrochemical cell and electrolytic cell **(5 marks)**

d) Predict whether zinc and silver react with 1N sulphuric acid to give out hydrogen gas or not. Given that the standard reduction potentials of zinc and silver are -0.76 volt and 0.80 volt respectively **(4 marks)**

e) A zinc electrode is placed in 0.1 M solution of zinc sulphate at 25°C. If the degree of dissociation of salt at this concentration is found to be 0.5, calculate the electrode potential of the electrode at 25°C. Given that $E^o_{Zn^{2+},Zn} = -0.76volt$ **(4 marks)**

QUESTION 4 (18 marks)

a) The vapour pressure of two pure liquids A and B are 15000 and 30000 Nm^{-2} at 298 K. Calculate the mole fraction of A and B in the vapour phase when an equimolar solution of the liquids is made **(3 marks)**

b) i) When 58.5g salt of NaCl is dissolved into 1liter pure water, it forms a solution whose boiling point is higher than of pure water. Explain. **(2 marks)**

ii) Explain which of the solutions 0.1M NaCl and 0.1M PbCl$_2$ would have a higher boiling point **(2 marks)**

c) Study the phase diagram of water below and answer the questions that follow.
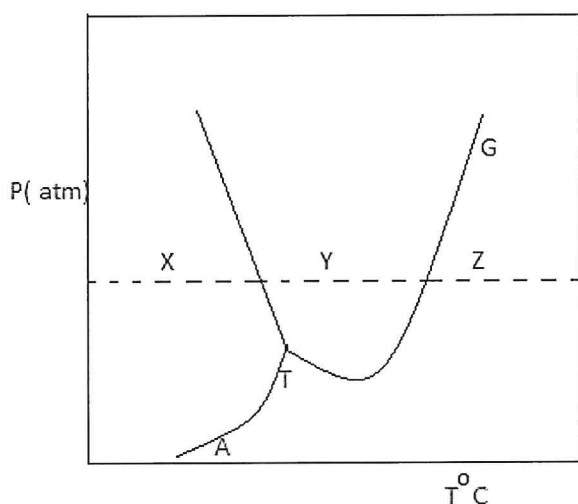

i) Describe the process along the curve AT **(1 mark)**

ii) What is the significance of point G **(2 marks)**

iii) Explain the transformation of XYZ **(2 marks)**

d) i) Hexane and heptane were mixed to form an ideal solution. At 100^{0}C, the vapour pressure of two liquids (Hexane and heptane) are 190kPa and 45kPa respectively. What will be the vapour pressure of the solution obtained by mixing 25g of hexane and 35 g of heptane will be **(2 marks)**

f) Study the boiling point- composition curve for ethanol-water
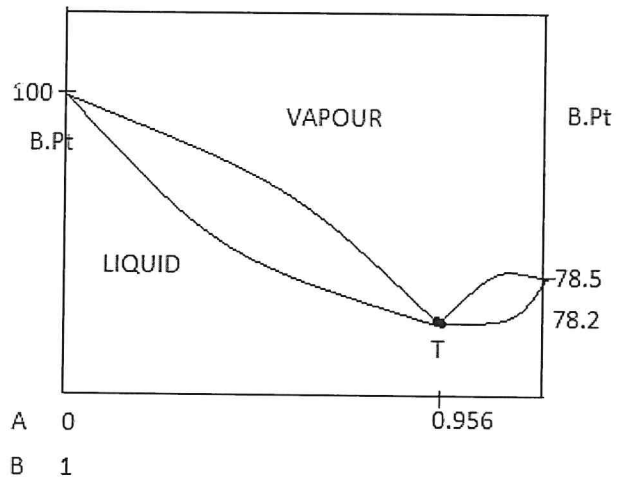
i) Identify A and B   **(2 marks)**

ii) Name point T and explain its significance in fractional/ steam distillation of ethanol from molasses   **(2 marks)**