[*University of Choice*]

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

MAIN EXAM

2023/2024 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN PUBLIC HEALTH

COURSE CODE: PPP 115

COURSE TITLE: PRINCIPLES OF CHEMISTRY

DATE: 6.12.2023 TIME: 11.00-1.00 PM

INSTRUCTIONS TO CANDIDATES: ANSWER QUESTION ALL QUESTIONS

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

Paper Consists of 4 Printed Pages. Please Turn Over

constants

$R = 8.31451$ J/Kmol.

STP 22.4

QUESTION ONE (18 MARKS)

a) Define the following terms, giving relevant examples in each (3 marks)
   i. Catenation
   ii. Electro negativity
   iv. Nucleophilicity

b) Write shorts notes about the following scientists **(6 marks)**
i) John Dalton - Atomic Theory
ii) J.J. Thompson
iii) Ernst Rutherford

c) Give the electron configurations of the following atoms and ions **(2 marks)**
   i. Zr
   ii. V^{+3}

d) You place 2.80 g of phosphoric acid (H_3PO_4) into 150.0 mL of a 1.00 M sodium hydroxide solution. If the total volume remains constant, identify the following: **(5 marks)**

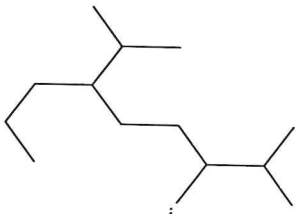
i) The concentration of sodium ion at the completion of the reaction:
ii) The concentration of phosphate ion at the completion of the reaction:
iii) The concentration of hydroxide ion at the completion of the reaction:

e. Phytane is a naturally occurring alkane produced by the alga spirogyra and is a constituent of petroleum. The IUPAC name for phytane is, 2,6,10,14-tetramethyl hexadecane. Write a structural formula for phytane. (2 marks)

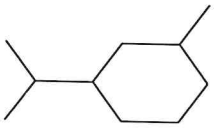
QUESTION TWO (17 MARKS)

a) Aluminum (Al) is a metal with a high strength-to-mass ratio and a high resistance to corrosion; thus it is often used for structural purposes. Compute both the number of moles of atoms and the number of atoms in a 10.0 g sample of aluminum. **(4 marks)**
b) Calcium carbonate ($CaCO_3$), also called *calcite,* is the principal mineral found in limestone, marble, chalk, pearls, and the shells of marine animals such as clams.
i) Calculate the molar mass of calcium carbonate. **(4 marks)**
ii) A certain sample of calcium carbonate contains 4.86 moles. What is the mass in grams of this sample? What is the mass of the CO_3^{2-} ions present? **(3 marks)**
c) Describe any four factors that may cause yields of a chemical reaction to be less than 100%. **(4 marks)**

a) Give the IUPAC names of the following compounds **(3 marks)**



i



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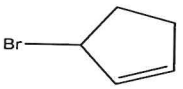
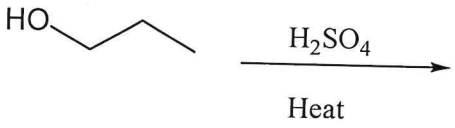
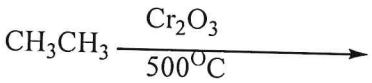


iii

b) Complete the following organic reactions **(2 marks)**

i)





QUESTION THREE (18 MARKS)

a) State the following gas laws (3marks)

i. Gay Lussac's law

ii. Avogadro's law

iii. Raoults law

b) For instance, suppose you had a gas at 15.0 atm pressure at a volume of 25.0L and a temperature of 300K.what would the volume of the gas be at standard temperature and pressure? (3 marks)

c) State four assumptions of the kinetic theory of gases (4 marks)

d) (i) Define the term partial pressures of a gas (1 marks)

(ii) What is the total partial pressure of a mixture of H_2 and O_2 where the partial pressure is 0.800 atm and 0.198 atm respectively (2 marks)

e. c) A certain malt liquor contains 7% ethanol (C_2H_5OH) by mass. Calculate the mole fraction, molarity and molality. (5marks).
Assume that: in the same 100g sample the volume is 100ml

QUESTION FOUR (17 MARKS)

a) State the law of mass action giving example expression (4 marks)

b) In Haber experiments,0.025 mol of $H_2(g)$ and 0.010 mol of $N_2(g)$ were combined in a 2L vessel at 472°C.The mixture was the allowed to come to equilibrium and the concentration of $NH_{3(g)}$ observed to be 3.18 x 10-5M .Calculate K_C for the Haber reaction. (6 marks)

c) State four characteristics of an equilibrium state (4 marks)

d) State three factors that affect the solubility of a solid (3 marks)