NATIONAL OPEN UNVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PURE & APPLIED SCIENCES
2021_1 EXAMINATION1234

COURSE: CHM424- NON AQUEOUS SOLVENTS TIME ALLOWED: 2 HOURS
INSTRUCTION: ANSWER QUESTION ONE (1) AND ANY OTHER THREE (3) QUESTIONS

QUESTION 1

(a) What is refractive index and what is its significant as a solvent property **(7 marks)**

(b) Write chemical equations to show the ionization of the following acids and bases according to Arrhenius theory (acid: HCl, H_2SO_4 and HNO_3, bases: NaOH, $Ca(OH)_2$ and $Mg(OH)_2$ (10 marks)

(c) Write all possible equations that can represent ionization of tetraoxosulphate (IV) acid according to Bronsted-Lowry concept of acid. State the conjugate acid and base in all the equations. **(6 marks)**

(d) Is there any relationship between the strength of a conjugate acid and its corresponding conjugate base? **(2 marks)**

QUESTION 2

(a) Compare the features of amphiprotic solvents with that of water (use suitable examples to support your answer) **(8 marks)**

(b) State two characteristics of protonic solvents and give two examples **(7 marks)**

QUESTION 3

(a) What factor characterize the extent of charge separation within a molecule **(1 mark)**

(b) The dipole moment of HCl is 1.11D and the distance between atoms is 127 pm. What is the percentage ionic character of the HCl bond ? **(4 marks)**

((**Note 1 Debye = 3.3356 x 10^{-30} Ams (ampere meter second) = 3.3356 x 10^{-30} Cm)**

(c) State the three forces if interaction in a solution and which of then is significant in solute dissolution **(4 marks)**

(d) In one sentence for each, highlight the four types of interaction that are significant in the formation of a solution between solute and solvent **(4 marks)**

(e) Write the Coulomb equation that accounts for interaction between partial negative and positive charges **(2 marks)**

QUESTION 4

(a) Why is nitrosyl chloride expected to be a strong ionizing solvent and what is the shortcoming **(3 marks)**

(b) Write suitable equations show the reaction of NOCl with various forms of silver phosphate **(9 marks)**

(c) State three reason why dinitrogen tetroxide is widely used as a medium for chemical reactions and as a reactant in liquid phase **(3 marks)**

QUESTION 5

(a)(i) Why is liquid SO_2 a good solvent for covalent compounds **(2 marks)**

(b) With the aid of suitable equations, explain the similarity of autoionization reaction of liquid $SO_2$with that of water and liquid ammonia**.** **(7 marks)**

(c) Comment on the acidic or basic behaviour of substances in liquid SO_2 with respect to autoionization of SO_2. Give an example to support your answer. **(3 marks)**

(d) Write autoionization equations for arsenic chloride, arsenic bromide and arsenic fluoride **(3 marks)**