



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

REGULAR PROGRAMME

CHEM 103: ACIDS AND BASES

Date: JULY 2018

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and any other Two Questions

- Q1. a) Define and give an example of
- i) Traditional acid
 - ii) Bronsted acid
 - ii) Lewis acid **(3 marks)**
 - iv) Explain why both pure HCl gas and HCl dissolved in a non-polar solvent exhibit no acidic properties in the traditional sense, whereas HCl aqueous does exhibit **(2marks)**
- b) i) Define and give an example of a binary and diprotic acid **(2 marks)**
- ii) Draw and name electron-dot formulas of the four oxyacids of chlorine **(4 marks)**
 - iii) Explain why H_3PO_4 , which contains three hydrogen atoms per molecule is weak acid whereas HCl which contains only one hydrogen atom per molecule is a strong acid **(2marks)**
 - iv) Explain the relationship between the strength of an acid and that of its conjugate base **(2marks)**

- c) i) Explain what would be observed concerning the favored direction of proton transfer reactions **(4 marks)**
- ii) Write a two step reaction that describes the ionization of sulfuric acid in dilute aqueous solution **(4 marks)**
- iii) Write an equation to illustrate that MgO is a basic anhydride **(2 marks)**
- d) i) Write a chemical and net ionic equations for the reactions between Ca(s) and HCl(aq) **(3marks)**
- ii) Distinguish between an acid anhydride and a base anhydride in terms of their chemical make up **(2 marks)**
- Q2. a) i) Explain the relationship between Normality and Molarity of a solution **(2 marks)**
- ii) What is the molarity of 0.06 Sr(OH)₂ solution **(3 marks)**
- b) 0.001M solution of HNO₃ has been prepared for the laboratory experiment.
Calculate i) the [H₃O⁺] of the solution
ii) the [OH⁻] of the solution **(5 marks)**
- c) Explain the main categories of indicators used by chemists **(6 marks)**
- d) Other than the use of indicators, how else can the end point of titration experiment or the P^H of a solution be determined **(4 marks)**
- Q3. a) Water quality depends upon the ability of waste water treatment facilities to reprocess waste water entering the treatment facility. Most of waste water facility use living organisms to break down wastes. Due to acidic rain the acidic nature of waste water can pose problems for a waste treatment plant. Make an inference as to how P^H affects waste water treatment. **(10 marks)**
- b) i) What is the basis upon which the indicator is selected for a particular titration experiment **(3 marks)**
- ii) A titration requires 50.0ml of 0.100N solution to reach an end point with 10.0ml of acetic acid solution. Determine the normal concentration of the acetic acid solution **(5 marks)**

- iii) Why would normality be more useful measure of a solution concentration when dealing with reactions between two different solutions **(2 marks)**
- Q4. a) Describe four types of reactions involving aqueous acids **(8 marks)**
- b) Explain how the presence of oxygen atoms in a compound may make the compound more acidic **(4 marks)**
- c) Distinguish a mineral and organic acid, giving an example of each **(4 marks)**
- d) In general which periodic table elements form acidic, basic and amphoteric oxides **(4 marks)**
- Q5. a) The P^H of a solution is measured and determined to be 7.52,
- i) what is the hydronium ion concentration **(3 marks)**
- ii) what is the hydroxide ion concentration **(3 marks)**
- iii) is the solution acidic or basic **(1 mark)**
- b) Explain how production of sulfuric acid can affect a countries and regional economy **(10 marks)**
- c) Describe how acid-base indicator functions **(3 marks)**

END