TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

DES 16S AND DFQA 16S

ACH 2105: FUNDAMENTALS OF CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

<u>Instructions to Candidates</u>
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE

a) Explain why 2-methylbutane have higher boiling point than 2,2-dimethylpropane (4 marks)

b) Briefly discuss the principles and rule governing the distribution of electrons in an orbital (6 marks)

c) What is the pH of a buffer solution made from dissolving 2.0g of benzoic acid (C_6H_5COOH) and 5.0g of sodium benzoate (C_6H_5COONa) in 250 cm^3 of water? Given
$K_{a\ benzoic\ acid} = 6.3 \times 10^{-5}$ mol dm^{-3}, H = 1, C = 12, O = 16, Na = 23 (5 marks)

d) Write electronic configuration in form of sp notation of $_9$F and $_{11}$Na (4 marks)

e) Calculate the pH of a buffer solution made from dissolving 2.0g of benzoic acid and 5.0g of sodium benzoate in 250 cm^3 of water? (4 marks)

f) Explain the relationship between the atomic size and the ionisation energy (4 marks)

g) What is the pH of 10^{-3} mol dm^{-3} H_2SO_4 (0.001 M H_2SO_4)? (3 marks)

Question TWO

a) The pH of 0.01 mol dm-3 of ethanoic acid *(acetic acid),* CH_3COOH is 3.40 at 25 °C.
What is the dissociation constant of ethanoic acid at this temperature? (6 marks)

b) Draw and name isomeric structural of a compound with molecule formulae. C_5H_{10} (6 marks)

c) State any THREE applications of radioactivity. (3 marks)

d) Differentiate between Wavelength and wave number   (2marks)

Question THREE

a) 50.0 cm^3 sample of sulphuric acid was diluted to 1.00 dm^3. A sample of the diluted sulphuric acid was analysed by titrating with aqueous sodium hydroxide. In the titration, 25.0 cm^3 of 1.00 mol dm^{-3} aqueous sodium hydroxide required 20.0 cm^3 of the diluted sulphuric acid for neutralisation.
  (i) Give the equation for the full neutralisation of sulphuric acid by sodium hydroxide.   (2marks)
  (ii) Calculate how many moles of sodium hydroxide were used in the titration?   (2marks)
  (iii) Calculate the concentration of the diluted acid.   (2 marks)
  (iv) Calculate the concentration of the original concentrated sulphuric acid solution.   (2 marks)

b) Draw the Lewis Structures for the following compounds
   (i) Aluminium oxide   (2marks)
   (ii) Aluminium chloride   (2marks)
(c) Define an acid and a base according to Arrhenius theory .   (2marks)
(d) Differentiate between dissociation and dissolving with respect to chemical compounds (1marks).

Question FOUR

a) 13.2 g of iron (III) alum were dissolved in water and reduced to an iron (II) ion solution by zinc and dilute sulphuric acid. The mixture was filtered and the filtrate and washings made up to 500 cm^3 in a standard volumetric flask. If 20.0 cm^3 of this solution required 26.5 cm^3 of 0.0100 mol dm^{-3} KMnO$_4$ for oxidation.
   (i) write the ionic equation for the reduction of iron(III) ions by zinc metal   (2marks)
   (ii) Calculate the percentage by mass of iron in iron alum   (4marks)

b) Explain the following rules with reference to the atomic structure
   (i) Hund's rule   (2marks)
   (ii) Pauli Exclusion Principle   (2marks)
 c) (i) State TWO condition for formation of hydrogen bond.   (2marks)
   (ii) Give THREE examples of molecules that form hydrogen bonds   (3marks)

Question FIVE

  a) Define binding energy and explain the relationship between binding energy and mass deficiency of a nucleus atom   (6marks)
  b) State any four precautions that should be taken against corrosive liquids   (4 Marks)
  c) Calculate the pH of a solution containing 0.100 mol dm^{-3} of ammonia and 0.0500 mol dm^{-3} of ammonium chloride given that K$_a$ value for the $NH_4^+{}_{(aq)}$ is 5.62 x 10^{-10} mol dm^{-3} (5 marks)