EMBU UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2013/2014

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION, MANAGEMENT OF AGRO-ECOSYSTEM AND ENVIRONMENT, AGRICULTURE, RANGE MANAGEMENT AND WATER RESOURCES MANAGEMENT

ACH 101/AWM 103: CHEMISTRY FOR AGRICULTURAL SCIENCES

DATE: NOVEMBER 29, 2013   TIME: 2.00 – 4.00PM

INSTRUCTIONS

Answer Question ONE and ANY Other TWO Questions

QUESTION ONE (30 MARKS)

a) Identify the group and period of the periodic table to which the elements with the following electron configuration would belong. Explain your answer in each case   (5 marks)
  - i.) $1s^2 2s^2 2p^6\ 3s^2$
  - ii.) $[Ar]4s^2$

b) Calculate the pH of the following solutions   (5 marks)
  - i.) 1M CH_3COOH ($K_a = 1.85 \times 10^{-5}$)
  - ii.) 2M HCl

c) Distinguish between the following colloidal states   (5 marks)
  - i.) Sol and gel
  - ii.) Foam and mist

d) Give a general chemical reaction to show a decay process involving   (5 marks)
  - i.) Beta particle release
  - ii.) Alpha particle release

e) Given the general chemical reaction for a first order kinetics   (5 marks)

A $\longrightarrow$ Products

i.) Give a general reaction rate law for the reaction and explain all symbols used

ii.) Explain, using relevant equation, the relationship between the change in concentration of A with time

f) Give the respective functional group for the following organic classes   (5 marks)

      i.) Alkynes

      ii.) Aldehydes

      iii.) Esters

      iv.) Ketones

      v.) Carboxylic acids

QUESTION TWO

a) Hybridization scheme is used to explain observed characteristics of compounds. For the following chemical species

    i.) CH_4

    ii.) $BeCl_2$

        I. Identify the central element   (2 marks)

        II. Give electronic configuration of the central atom   (4 marks)

        III. Work out the most probable hybridization scheme of the central atom

                (10 marks)

        IV. Give bond angles and most probable geometry adopted by the molecule

                (4 marks)

QUESTION THREE

a) Chemical kinetics of any reaction is as important as its occurrence. A particular reaction was followed in a laboratory set-up and the following data was obtained

t(seconds)	0	200	400	600	1000
[A]	0.110	0.073	0.048	0.032	0.014

Given A is the chemical species

    i.) Graphically show that the reaction is first order kinetics   (10 marks)

    ii.) Calculate the rate constant of the reaction   (5 marks)

    iii.) What is the rate of reaction at after 100 seconds   (5 marks)

QUESTION FOUR

a) Molecular Orbital Theory (MOT) diagram has been used to predict existence of a molecule or otherwise. Justify that the following molecules exist or not   (20 marks)

    i.) He_2

    ii.) O_2

iii.) H_2

iv.) Li_2^{2+}

QUESTION FIVE

a) A radioactive reaction is known to follow first order kinetics given as

$$t_{\frac{1}{2}} = \frac{Ln\ 2}{k}$$

     i.)   Define all the symbols used   (2 marks)

     ii.)   Calculate the rate constant, K, given that half – life is 200 seconds   (4 marks)

b) Sketch a graph that shows the relationship between initial concentrations of a radioactive isotope with time. Explain the relationship   (4 marks)

c) Give all possible isomers of an alcohol with four carbons. Give systematic names of the various isomers (Consider only position of –OH changing)   (6 marks)

d) Give four distinguishing characteristic of a colloidal solution   (4 marks)

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