CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATIONS FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE (BIO)

CHEM 334: ORGANIC CHEMISTRY IV

STREAMS: BSC (CHEM) **TIME: 2 HOURS**

DAY/DATE: MONDAY 08/4/2019 **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS: Answer question **One** (Compulsory) and any other **Two** questions

QUESTION ONE [30 MARKS]

(a) Write the IUPAC name of each of the following compounds (6 marks)

(b) Draw a bond-line structure for each of the following amino acids (4 marks)

(i) L-Leucine (ii) L-Tryptophan (iii) L-Methionine (iv) L-Valine

(c) Draw the form of the amino acid that is expected to predominate at the stated pH (2 marks)

(i) Lysine at a pH of 9.5 (P_{ka} values: α-COOH =2.18; α-NH_3^+ =8.95; side chain = 10.53)

(ii) Glutamic acid at a pH of 3 (P_{ka} values: α-COOH =2.19; α-NH_3 =9.67; side chain = 4.25)

(d) Calculate the isoelectric point (pI) of the following amino acids (3 marks)

(i) L-Alanine (P_{ka} values: α-COOH =2.34; α-NH_3 =9.69)

(ii) L-Lysine (P_{ka} values: α-COOH =2.18; α-NH_3^+ =8.95; side chain = 10.53)

(iii) L-Glutamic acid (P_{ka} values: α-COOH =2.19; α-NH_3 =9.67; side chain = 4.25)

(e) Identify the reagents necessary to make each of the following amino acids via the amidomalonate synthesis (6 marks)

(i) Isoleucine (ii) Alanine (iii) Valine

(f) Draw the structure of the major product(s) for each of the following reactions (3 marks)

(g) Describe, with the aid of suitable examples, three methods that are used to synthesize cycloalkanes (6 marks)

QUESTION TWO [20 MARKS]

(a) Label each of the following molecules as aromatic, antiaromatic or non-aromatic (3 marks)

(b) Describe, with the aid of suitable examples, two methods of preparing anthracene (4 marks)

(c) Write the major organic product(s) of naphthalene with each of the following reagents (3 marks)

(i) Na, CH_3CH_2OH (ii) CrO_3, AcOH (iii) Conc. HNO_3, conc. H_2SO_4

(d) Discuss three methods that can be used to separate mixtures of amino acids (10 marks)

QUESTION THREE [20 MARKS]

(a) Give the reagents that can be used to effect each of the following transformations (**4 marks**)

(b) (i) Describe with the aid of relevant equations the synthesis of Leu-Val-Ala tripeptide using the Merrifield method (8 marks)

(ii) State two advantages of the Merrifield method (2 marks)

(c) Explain the Baeyer strain theory (3 marks)

(d) Describe with the aid of suitable examples, two methods that are used to prepare cycloalkenes (3 marks)

QUESTION FOUR [20 MARKS]

(a) Write the name of each of the following compounds (3 marks)

(b) Draw the structure of the peptide that corresponds with the following sequence of amino acid residues: Trp-Val-Ser-Met-Gly-Glu (5 marks)

(c) Discuss the structure of proteins (6 marks)

(d) Discuss the relative stabilities of the chair, the twist and the boat conformations of cyclohexane (6 marks)
