JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (BIOLOGICAL SCIENCES)

2ND YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR

MAIN CAMPUS - REGULAR

COURSE CODE: SBI 3216

COURSE TITLE: INTRODUCTORY BIOCHEMISTRY

EXAM VENUE: BIO LAB   STREAM: (BIO)

DATE: 25/04/16   EXAM SESSION: 9.00 – 11.00 AM

TIME: 2 HOURS

Instructions:

1. **Answer ALL questions in Section A and Any two questions in Section B**

2. **Candidates are advised not to write on question paper**

3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A: ANSWER ALL QUESTIONS (30 MARKS)

1) Define the following terminologies
i)   Metabolic pathway   (1 mark)
ii)   Isoelectric point   (1 mark)
iii)   Reducing sugars   (1 mark)
iv)   Polyprotic acid   (1 mark)

2) Amino acids are generally dipolar ions or zwitterionic in nature. Briefly describe how this dipolar ion nature contributes to the unusual properties of amino acids   (4 marks)

3) The herbicide *glyphosate* (Roundup®) kills plants by inhibiting an enzyme needed for synthesis of phenylalanine. Deprived of phenylalanine, the plant cannot make the proteins it needs, and it gradually weakens and dies. Although a small amount of glyphosate is deadly to a plant, its human toxicity is quite low. Suggest why this potent herbicide has little effect on humans
       (2 marks)

4) Draw the Haworth projections of a dimer of glucose having β-1,4 linkage between glucose molecules in β-form   (4 marks)

5) Give the common name of the disaccharide you drew in question 4 above and the name of the polysaccharide that is formed from the disaccharide.   (2 marks)

6) Using a diagram, illustrate the change in energy during enzyme catalysis.   (4 marks)

7) Enumerate key points about structure and properties of triacylglycerols.   (4 marks)

8) Between stearic acid (18:0) and α-linolenic acid (18:3n-3), which occurs as a liquid at room temperature and explain why?   (3 marks)

9) Briefly illustrate how geometric isomerism (*cis* and *trans* conformation) affects the physical properties of fatty acids   (3 marks)

SECTION B: ANSWER ANY TWO QUESTIONS (40 MARKS)

10. a) Discuss the term metabolism and describe in detail the fundamental differences between anabolism and catabolism highlighting the role of ATP in coupling of the above reactions?
       (10 marks)

b) Glucose, with four (4) asymmetric carbon atoms, can form 16 isomers. Using illustrations, describe five (5) important isomerism found with glucose   (10 marks)

11. a) Discuss protein structure   (10 marks)

b) Describe the 3 dimensional structure of DNA.   (10 marks)

12.   a) Explain the importance of hydrogen bonds towards unique physical properties of water (6 marks)

b) Buffers are important physiological compounds that resist pH. Using benzoic acid (C_6H_5COOH, $pK_a = 4.19$) as an example, illustrate how buffering can be achieved stating clearly the suitable acid/conjugate base pair for this buffering system to work   (4 marks)

c) i) Derive the Henderson-Hasselbach equation   (4marks)

ii) Calculate the pH of a buffer system that contains 135g lactic acid (MW=90.8) and 89g sodium lactate (MW=112.06) in 1 litre solution. (Lactic acid $pK_a = 3.85$)   (3 marks)

iii) What will the pH of the resulting solution when 20mL of 10mM nitric acid is added to above (ii)?   (3 marks)

13. Discuss the glycolytic pathway of glucose metabolism   (20 marks)