



# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2016/2017 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER  
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (CHEMISTRY)

**COURSE CODE:** SCH 232

**COURSE TITLE:** CHEMISTRY OF BIOMOLECULES

**DURATION:** 2 HOURS

**DATE:** 19<sup>TH</sup> SEPTEMBER 2017 **TIME:** 2:30 PM – 5:30PM

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**INSTRUCTIONS TO CANDIDATES**

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 5 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

**QUESTION ONE [30 MARKS]**

a. Define the following terms:

**(5 marks)**

- i. Enzyme cofactor
- ii. Hydrolases
- iii. Transferases
- iv. Asymmetric carbon
- v. A dextrorotatory substance

b. Briefly explain three environmental factors that affect UV-Visible absorption by nucleic acid in UV-Vis spectrophotometry.

**(6 marks)**

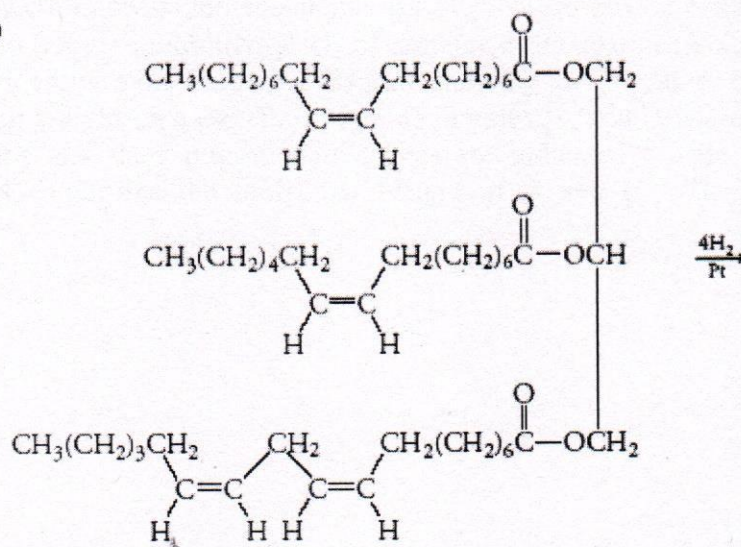
c. Penicillins are a class of antibiotics that work by irreversibly inhibiting a bacterial enzyme called DDtranspeptidase involved in construction of bacterial cell walls. Briefly explain the mode of action of Penicillins.

**(3**

**marks)**

d. Unsaturated triglyceride is converted to a saturated triglyceride by reaction with hydrogen in the presence of a catalyst. Draw and explain why the structures of the product formed when H<sub>2</sub> was in limited supply and when it was excess are different.

**(3 marks)**

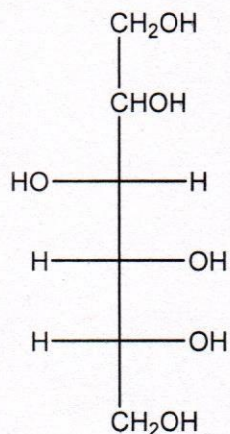


e. Giving an example in each case differentiate the following terms:

**(6 marks)**

- i. Saturated and monounsaturated fatty acids
- ii. Polar neutral amino acids and polar acidic amino acids
- iii. Oligosaccharides and polysaccharides

f. Carefully study the structure of fructose below and answer the questions that follow.

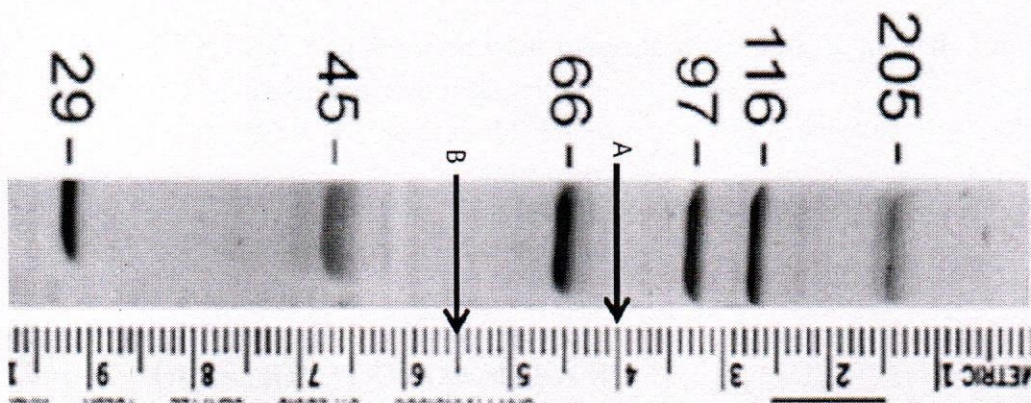


- i. Giving an explanation, identify whether compound is a D or L isomer. **(2 marks)**
- ii. Draw mirror image of the compound and indicate whether it is a D or L isomer. **(1 marks)**
- iii. How many isomers will the compound above have? **(2 marks)**
- iv. In which direction will the mirror image of fructose drawn above rotate plane polarised light? Explain. **(2 marks)**

#### QUESTION TWO [20 MARKS]

- a. In gel electrophoresis, molecular masses of proteins can be estimated by comparing the migration (relative mobility or  $R_f$ ) of proteins of interest to standards of known size. You are provided with the following diagram showing the migration of proteins with different molecular weight on a gel. Two proteins samples (A and B) were separated under similar conditions and their migration distances are indicated on the gel. Showing the steps involved, determine the molecular weight of A and B. NB: MW is given in  $\times 1000$  daltons.

**(10 marks)**



b. Outline any two roles of each of the following steps during isolation of nucleic acids.

i. Cell lysis:

(2 marks)

ii. Enzymatic treatment:

(2 marks)

iii. Phenol extraction:(2 marks)

c. You are provided with a mixture of adenine nucleotides containing adenosine, adenosine monophosphate (AMP), adenosine diphosphate (ADP) and adenosine triphosphate (ATP).

i. Using formate as counter ions explain how you would separate the mixture into its constituents using ion chromatography.

(2 marks)

ii. Giving an explanation, show the order of elution.

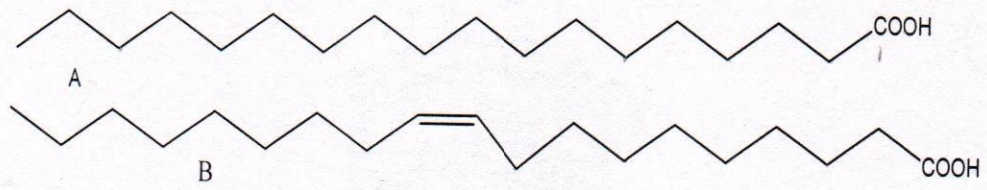
(2 marks)

**QUESTION THREE [20 MARKS]**

- a) Which type of High Performance Liquid Chromatography technique is most widely used? (1 mark)
- b) What is the separation principle in Size Exclusion Chromatography?(2 marks)
- c) Why is it necessary to degass the mobile phase? (1 marks)
- d) Which is the most commonly used detector in High Performance Liquid Chromatography and why? (1 mark)
- e) What are the proper uses for agarose and acrylamide gels? (2 marks)
- f) Can you describe what happens when milk is converted into curd or yoghurt from your understanding of proteins? (3 marks)
- d. What are the desirable features of a HPLC detector? (5 marks)
- g. What do you understand by theoretical plate concept and how HETP affects the separation of HPLC column? (5 marks)

#### QUESTION FOUR [20 MARKS]

- a) Draw a sketch showing the basic components of spectrophotometric instruments and label the parts. (5 marks)
- b) To determine the enzyme activity of acetyl choline esterase in the reaction  
 acetylthiocholine  $\rightarrow$  thiocholine + acetate (catalyzed by ACHE) and thiocholine + DTNB  
 $\rightarrow$  5TNB + oxidized thiocholine, in a sample with a protein concentration of 0.34 mg/ml, 30  $\mu$ l of the sample are added to a cuvette in final volume of 1 ml containing all the necessary substrates. The  $A_{405}$  increases from 0.015 to 0.287 in 10 minutes. The  $A_{405}$  of a blank containing all the same reagents except the protein sample goes from 0.014 to 0.073 in 10 minutes. The  $\epsilon_{405}$  for 5TNB is  $13.3 \times 10^3 \text{ litcm}^{-1}\text{mol}^{-1}$ . Use this information to answer the questions that follow.
- i. Plot a graph for the data from the spectrophotometer. (5 marks)
  - ii. Determine the enzyme activity in the reaction. (2 marks)
- c) Explain the following occurrences: (4 marks)
- i. Animal fats are solid while vegetable oils are liquid at room temperature:
  - ii. The boiling point of the fatty acid (A) in the figure below is higher than that of (B).



- d) Explain the following types of chromatography as used in the separation of proteins. **(4 marks)**
- i. Reverse phase chromatography:
  - ii. Hydrophobic interaction chromatography: