

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

### THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN BIOCHEMISTRY

**BIOC 241: INTEGRATED LABORATORY TECHNIQUES 1**

**STREAMS: BSC. BIOCHEMISTRY Y2S2**

**TIME: 2 HOURS**

**DAY/DATE: TUESDAY 6 /07/ 2021**

**2.30 PM – 4.30 PM**

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#### **INSTRUCTIONS:**

- Answer Question ONE and any other TWO Questions.
- Do not write on the question paper

#### **Questions**

##### **1. Question 1 (Compulsory) (30 marks)**

- a) Describe the principle behind affinity chromatography (4 marks)
- b) A researcher wants to separate two peptides by ion exchange chromatography. At the pH of the mobile phase to be used on the column, one peptide (A) has a net charge of -3, due to the presence of more Glu and Asp residues than Arg, Lys, and His residues while Peptide B has a net charge of -1.
- (i). Define ion-exchange chromatography (1 mark)
- (ii). Which peptide would elute first from a cation-exchange resin? Justify your answer (2 marks)
- (iii). Which peptide would elute first from an anion-exchange resin? Justify your answers (2 marks)
- c) A mixture containing five amino acids (Ala, Asp, Gly, Phe, Pro) was analyzed using cellulose-coated thin layer chromatography. The solvent system was n-propanol/water (70/30 v/v). Justifying your answer, predict the order of the mobility of the amino acids (low,  $R_f$  to high,  $R_f$ ) on the chromatograms. (5 marks)

- d) Describe the different methods of determining the pH in the laboratory. (6 marks)
- e) Describe the various protein buffer system (5 marks)
- f) List the applications of spectrophotometry. (5 marks)

**2. Question 2 (20 marks)**

- a) Describe the various detection methods used in HPLC. (10 marks)
- b) A student wants to separate a hypothetical mixture of proteins X, Y and Z using size-exclusion chromatography. The respective molecular weights of individual proteins are: Protein X= 300g, Protein Y=5000g and Protein Z=1000g
  - (i). Show in what order the proteins will elute from the column (3 marks)
  - (ii) Justify your answer in 2(i) above and explain in details the principle behind the separation (7 marks)

**3. Question 3 (20 marks)**

- a) Describe the different conditions associated with acid- base imbalance in the body (10 marks)
- b) Explain the principle behind gas chromatography. (5 marks)
- c) Describe the components of flow cytometry. (5 marks)

**4. Question 4 (20 marks)**

- a) Describe the role of the kidney in maintaining bicarbonate buffer system (6 marks)
- b) Explain in details any 4 major applications of radioisotopes techniques in biochemistry and biotechnology (8 marks)
- c) Define the following terms as used in radioactivity.
  - (i). Bequerel (2 marks)
  - (ii) Curie (2 marks)
  - (iii) Specific activity (2 marks)

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