CHUKA UNIVERSITY
UNIVERSITY EXAMINATIONS 2020/2021
SECOND SEMESTER EXAMINATION
BIOC 241: INTEGRATED LABORATORY TECHNIQUES I

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INSTRUCTIONS: *Answer question **one** and **any other two** questions*

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)