



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY BIMBT 11 M

SBH 2202: BIOMEDICAL TECHNIQUES & INSTRUMENTATION I

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

- a) Illustrate the ultra-violet absorption spectra of equimolar solution of NAD^+ acid
(5marks)
- b) 3.48g of K_2HPO_4 and 2.27g of KH_2PO_4 were dissolved in 250ml of de-ionized water. Calculate the pH of the result of solution ($\text{pK}_a = 7.2$, $\text{K} = 39$, $\text{H} = 1$, $\text{P} = 31$, $\text{O} = 16$)
(5marks)
- c) Explain the effects of sodium dodecyl sulphate (SDS), β -menapto ethanol and urea in the activity of proteins during electrophoresis.
(5marks)
- d) An ehzymatic reaction as carried out in 100ml of 0.1 molh^{-1} autate buffer at pH of 4.76 during the fractionation; 3M of Hydrogen (H^+) were produced. Calculate the final pH of the mixture if the pK_a of acetic acid is 4.76
(6marks)
- e) 750ml of serum containing 2.5m units ml^{-1} of an enzyme activity and 14 mgml^{-1} of protein was fractionated using 30% $(\text{NH}_4)_2 \text{SO}_4$. The obtained fractions had an activity of $2.0 \mu \text{ units ML}^{-1}$ in a total volume of 150ml and a total protein of 25 mgML^{-1}
 - (i) Explain how you would prepare 50% $(\text{NH}_4)_2 \text{SO}_4$ solution from the 30% $(\text{NH}_4)_2 \text{SO}_4$ solution
(3marks)

- (ii) Calculate the specific activity of the fraction **(3marks)**
- (iii) Calculate the total activity of the fraction **(3marks)**

Question TWO

- a) Different proteins of different molecular weights were precipitated using different acetone concentration (% vol/vol) as shown in the table below.

Molecular weight (Dalton)	Acetonic Concentration (% vol/vol)
39811	7.5 – 12.5
31623	17.5 – 22.5
25119	27.5 – 32.5
19953	37.5 – 42.5
15849	47.5 – 52.5
12589	57.5 – 62.5

A protein of unknown molecular weight was precipitated by 22.5 – 27.5 (% vol/vol) of acetone. Approximate the molecular weight of the protein **(10marks)**

- b) Explain the principle employed in protein separation by
- (i) Altering the pH of the medium **(5marks)**
 - (ii) Increasing the concentration of organic solvents **(5marks)**

Question THREE

- a) Considering a hypothetical weak acid, HA, deduce the Henderson-Hasselbach (H-H) equation **(10marks)**
- b) Describe the principle of ISO electric focusing in purification of a mixture of proteins **(10marks)**

Question FOUR

- a) Outline the role of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ during preparation of the slurry of silica gel or alumina in Tnc. **(2marks)**
- b) Explain how solute components that have been separated are identified in paper

chromatography

(9marks)

- c) Describe the use of ISO electric precipitation in purification of a mixture of proteins
(9marks)

Question FIVE

Discuss the factors that affect the mobility of Macro-molecules when subjected to electric field
(20marks)