



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN FORENSIC SCIENCE
SBC 103: PROTEINS AND ENZYMES I

DATE: Monday, 26th March, 2012

TIME: 2.00 p.m. – 4.00 p.m.

SECTION A: Answer All Questions (1 mark each)

Answer true or false the following questions in answers booklet

- 1 Ionic charge interactions in water are relatively strong in comparison to electrostatic interaction in the interior of a protein
- 2 Hydrolase can be considered as special group of transferases in which the group donor is transferred to water.
- 3 The sequence of amino acid in the protein polymer determines the tertiary conformation of the protein.
- 4 During SDS-electrophoresis all proteins are negatively charged and move towards cathode.
- 5 Carboxymethyl cellulose matrix is positively charged and appropriate for separation of positively charged proteins

Answer the following questions below:

- 6 List the parameters below for α -helix protein structure:
 - (i) Number of amino acid per turn
 - (ii) Helix pitch
- 7 Determine overall charge of the following peptide at physiological pH:
Ala-Val-Arg-Ala-Asp –Leu-Phe-Tyr-Glu-Gly-Asp-Thr
- 8 Name and write the reaction for the oxidoreductases class enzyme.
- 9 Name two hormones involved in the phosphorylation and dephosphorylation of the enzymes in the liver.
- 10 Name and draw the structure of reagent used for determination of N-terminal residue

Fill the gaps:

11 _____ and hsp 90 chaperone proteins are expressed during _____ and involved in regulating protein conformation in endoplasmic reticulum.

12 _____ regulator binds to the regulator site and induces a reversible conformational change in the enzyme that causes change in the kinetic properties of the enzyme.

13 _____ is a precipitation of proteins by addition of neutral salts to the protein solutions.

14 Michaelis-Menten equation is _____.

15 _____ inhibitor does not combine with free enzyme or affect its reaction with normal substrate; however, it does combine with ES-complex to give an inactive enzyme-substrate-inhibitor complex, which cannot undergo further reaction to yield the normal product.

For each of the following multiple choice, choose the most appropriate answer:

16 Cyanogen bromide is used in the protein reaction of?

- A Condensation
- B Partial hydrolysis
- C Alkylation
- D Reduction

17 Concentration of the protein can be determined by the reaction with?

- A Nynhydrin
- B Dansyl chloride
- C Chymotrypsin
- D Biuret reagent

18 Non-covalent interactions causes the following changes in the protein structure?

- A Hydrolysis of peptide bonds
- B Glycosylation of amino groups
- C Twisting and coiling of the molecule
- D Reduction of the cysteine residues

19 In the enzyme kinetics the equilibrium assumption for single substrate reaction is?

- A $k_1 [E] [S] = k_{-1} [ES]$
- B $k_1 [E] [S] = k_{-1} [ES] + k_2 [ES]$

$$C \quad [S][E]/k_1 + k_{-1} = [ES]$$

$$D \quad k_{-1}/k_1 = K$$

20 The example of covalent irreversible covalent modification of enzymes is?

- A Zymogens
- B Cofactors
- C Allosteric regulators
- D Glycosylation

Section B: Answer All Questions (5 marks each)

1a) Draw the reactions of ionizations for the lysine ($pK_{aCOOH}=2.2$; $pK_{aNH_3^+}=9.0$; $pK_R=10.5$);

(3 marks)

b) Explain how lysine contributes to the tertiary structure of the protein (2 marks)

2 Write the following reactions for the proteins

- (i) Reduction of cystine (1 mark)
- (ii) Biuret reagent (1 mark)
- (iii) Lipoprotein formation (1 mark)
- (iv) Glycoprotein formation (2 marks)

3 Explain the principle of gel filtration for the separation of proteins using as an example the mixture of the following proteins:

Ferritin (MW=440.000)
Catalase (MW=232.000)
Lactate dehydrogenase (140.000)
Albumin (67.000).

4a) Write the reaction of amino acid test used in amino acid analyzer (1 mark)

b) Outline the major steps in analysis of amino acid composition in the protein using amino acid Analyzer. (3 marks)

c) State the purpose of the above procedure in the strategy of determination of protein primary structure (1 mark)

5 a) State the glucokinase and hexokinase K_m for glucose (2 marks)

b) Using K_m for glucose explain the role of the above enzymes in the tissue glucose metabolism (3 marks)

6 a) Define the competitive inhibition of enzyme (1 mark)

b) Using diagram and equation,s explain molecular events during competitive inhibition (5 marks)

SECTION C: Answer Any Two Questions (10 marks each)

1a) Name three bonds which contribute to the protein primary and secondary structures. Explain the properties of the above bonds and their role in the protein ability to form secondary structure (5 marks)

b) Explain how hair protein secondary structure is changed by use of the following: (5 marks)

(i) water

(ii) heat

(iii) sulphur reductants

2 The proteins serum albumin ($pH_I=4.9$), lactoglobulin ($pH_I=5.2$), γ -globulin ($pH_I=6.6$) and ribonuclease ($pH_I=9.6$) were applied to a column of DEAE-cellulose at pH 6.5. The column was eluted with a dilute pH 6.5 buffer, and then with the same buffer containing increasing concentrations of sodium chloride.

(i) Explain how these proteins will be eluted from the column (6 marks)

(ii) Explain the use of the pH of eluting buffer and salt for separation of proteins by ion-exchange chromatography (4 marks)

3a) List two genes of alcohol dehydrogenase involved in functional polymorphism (2 marks)

b) Fill the table below for kinetic parameters and function of the ADH 2 isozymes (8 marks)

Isozymes of ADH 2	K _m for ethanol	V _{max}	Sensitivity to alcohol	Risk of alcoholism
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