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University Examinations 2023/2024

FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MEDICAL LABORATORY (UPGRADING)

HMU 3111: PROTEINS AND ENZYMES

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS:

(i) The paper consists of **Three** Sections
(ii) Section A: Multiple Choice Questions
(iii) Section B: Short Answer Questions
(iv) Section C: Long Answer Questions

SECTION A (20 MARKS)

1. What is the primary structure of a protein?
    A. The arrangement of multiple protein subunits
    B. The sequence of amino acids in a polypeptide chain
    C. The overall three-dimensional shape of a protein
    D. The presence of disulfide bonds between cysteine residues
2. Which enzyme is responsible for catalyzing the addition of a phosphate group to proteins during phosphorylation?
    A. Kinase
    B. Deacetylase
    C. Methyltransferase
    D. Ligase

3. Which part of the amino acid gives it its unique identity and properties?
    A. Amino group
    B. Carboxyl group
    C. Side chain (R-group)
    D. Hydrogen atom
4. Factors that affect separation of amino acids include all of the following EXCEPT:
    A. Solubility
    B. Size
    C. Rate
    D. Acid base property
5. A region within an enzyme that fits the shape of the reacting molecule called a substrate is called
    A. Active site
    B. Enzyme
    C. Product
    D. Enzyme substrate complex
6. The enzyme streptokinase is useful in:
    A. Regulating sugars
    B. Clearing blood clots
    C. Breakdown of cellulose
    D. Inflammation
7. In Michaelis-Menten kinetics, what does the term “Km” represent?
    A. The substrate concentration at half maximal velocity
    B. The enzyme concentration at half-maximal velocity
    C. The catalytic rate constant
    D. The turnover number
8. Which type of inhibition occurs when an inhibitor binds to the active site of an enzyme and prevents substrate binding?
    A. Competitive inhibition
    B. Non-competitive inhibition
    C. Mixed inhibition

D. Uncompetitive inhibition

9. Which of the following statements about enzyme kinetics is true?
    A. Enzymes alter the equilibrium of a reaction.
    B. Enzymes increase the activation energy of a reaction.
    C. Enzymes are consumed during a reaction.
    D. Enzymes increase the rate of a reaction by lowering the activation energy.
10. 1n tandem mass spectrometry, what ionization technique is commonly used to generate gas-phase peptide ions?
    A. Matrix-assisted laser desorption/ionization (MALDI)
    B. Electrospray ionization (EST)
    C. Fast atom bombardment (FAB)
    D. Secondary ion mass spectrometry (SIMS)
11. The following are zymogens produced in the pancreas EXCEPT
    A. Pro-insulin
    B. Chymotrpsinogen
    C. Pepsinogen
    D. Trypsinogen
12. The short DNA fragments that are placed onto a microarray are called
    A. Markers
    B. Probes
    C. mRNA
    D. Test sequence
13. Enzymes used as analytical reagents typically function by:
    A. Catalyzing the breakdown of substrates
    B. Catalyzing the formation of products
    C. Inhibiting the activity of other enzymes
    D. Acting as structural components in assays
14. A protein part of an enzyme without any co-factors that may be required for the enzyme to function is called
    A. Isozyme
    B. Zymogen

C. Apo enzyme

D. Holo enzyme

15. Tandem mass spectrometers are used to determine:

    A. Protein mass

    B. Enzyme activity

    C. Rate of protein

    D. Peptide sequence

16. An inherited metabolic disorder where there is progressive nerve damage, development delay in young children and eventually death is:

    A. Gaucher disease

    B. Krabbe's disease

    C. Tay-Sachs disease

    D. Hurler syndrome

17. In which of the following situations might you expect to see elevated levels of cardiac enzymes in plasma or serum?

    A. After a heart attack (myocardial infarction)

    B. After a bone fracture

    C. During a viral infection

    D. During pregnancy

18. According to the lock and key model, enzymes possess a specific:

    A. Active site that fits any substrate

    B. Active site that changes shape to accommodate different substrates

    C. Active site that precisely matches the shape of their substrate

    D. Active site that is irrelevant for substrate binding

19. In the lock and key model, what happens when the substrate binds to the enzyme's active site?

    A. The enzyme undergoes a conformational change

    B. The enzyme becomes inactive

    C. The enzyme and substrate remain unchanged

    D. The enzyme releases its cofactors

20. Which of the following enzymes is commonly used as a marker for myocardial infarction in diagnostic enzymology?

A. Lipase

B. Glucose-6-phosphatase

C. Creatine kinase (CK)

D. Alkaline phosphatase (ALP)

SECTION B (40 MARKS) ANSWER ALL QUESTIONS

1. Define the following terms: (5 Marks)

a) Substrate

b) protein micro array

c) Zymogen

d) Proteome

e) Apo enzyme

2. Describe the general structure of an amino acid. (5 marks)
3. With the aid of a simple diagram, discuss the workflow of a mass spectrometer (5 marks)
4. State 5 Symptoms of some Inherited Metabolic Disorders (5 marks)
5. Write on Ubiquitination as a post translational modification process (5 marks)
6. What arc the characteristics of an enzyme active site (5 Marks)
7. Outline the six main groups of enzymes (5 Marks)
8. Outline the secondary and tertiary structures of a protein. (5 marks)

SECTION C (40 MARKS) ANSWER ANY TWO QUESTIONS

1. a) Discuss using different examples how enzymes can be used as analytical agents (10 marks)

   b) Discuss the various mechanisms by which enzymes are regulated in biological systems (10 marks)
2. Write an essay on the different proteonomic technologies used in a modern laboratory and the applications of each technique (20 marks)

3. a) Discuss the cause, signs and symptoms, diagnosis and treatment of krabbe's disease (10 marks)

b) Explain how temperature, PH and the concentration of an enzyme can affect enzyme activity (10 marks)