KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.Tech.
Year : III

Course : BIOT 308
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 26 JUL 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and mark [X] in the most appropriate option from each set of choices

1. The reaction catalyzed by lyases is
   [ ] Isomerization
   [ ] Hydrolysis
   [ ] Elimination to form a double bond
   [ ] Joining of two molecules

2. What did Koshland propose in 1958?
   [ ] Lock and key hypothesis
   [ ] Induced fit theory
   [ ] Allosteric model
   [ ] Transition state theory

3. What does the first number in an Enzyme Commission (EC) number indicate?
   [ ] Subclass of the enzyme
   [ ] Serial number of the enzyme
   [ ] Type of reaction catalyzed
   [ ] Sub-subclass of the enzyme

4. What does the Michaelis constant (K_m) represent?
   [ ] Maximum velocity
   [ ] Half-maximal velocity substrate concentration
   [ ] Enzyme concentration
   [ ] Product concentration

5. What type of plot is used for determining kinetic constants from untransformed data?
   [ ] Lineweaver-Burk Plot
   [ ] Eadie-Hofstee Plot
   [ ] Michaelis-Menten Plot
   [ ] Hanes-Woolf Plot

6. What is the significance of k_{cat}/K_m?
   [ ] Maximum velocity
   [ ] Enzyme efficiency
   [ ] Substrate affinity
   [ ] Inhibition constant

7. What assumption is made about substrate concentration in the steady state model?
   [ ] Substrate concentration is equal to enzyme concentration
   [ ] Substrate concentration is much greater than enzyme concentration
   [ ] Substrate concentration is negligible
   [ ] Substrate concentration is constant

8. What type of inhibition occurs when the inhibitor binds exclusively to the free enzyme?
   [ ] Competitive inhibition
   [ ] Noncompetitive inhibition
   [ ] Uncompetitive inhibition
   [ ] Mixed inhibition

9. What is the characteristic of reversible inhibitors?
   [ ] They irreversibly bind to the enzyme
   [ ] They bind and can be removed by lowering their concentration
   [ ] They always form covalent bonds
   [ ] They cannot be diluted

10. Which type of inhibition can be diagnosed by unchanged Vmax and increased K_m?
[ ] Competitive inhibition [ ] Noncompetitive inhibition
[ ] Uncompetitive inhibition [ ] Allosteric inhibition

11. What is the most common standard unit of enzyme activity?
[ ] mg/min [ ] µmol/min [ ] g/min [ ] mol/sec

12. What is a common method used for the initial fractionation of enzymes?
[ ] Affinity chromatography [ ] SDS-PAGE
[ ] Precipitation by changing pH [ ] Isoelectric focusing

13. Which microorganism is used to produce glucose/xylose isomerase?
[ ] Bacillus [ ] Streptomyces [ ] Aspergillus [ ] Trichoderma

14. Which technique is used to desorb bound species in ion-exchange chromatography?
[ ] Changing pH [ ] Increasing temperature
[ ] Increasing ionic strength [ ] Decreasing ionic strength

15. During the enzymatic action of triosephosphate isomerase Glu165 acts as a
[ ] Base [ ] Acid
[ ] Oxidizing group [ ] Reducing group

16. Which is NOT a mechanism for transition state stabilization?
[ ] Approximation of reactants [ ] Covalent catalysis
[ ] Increasing the reaction temperature [ ] General acid-base catalysis

17. Which amino acid side chain is likely to be involved in general acid/base catalysis?
[ ] Arginine [ ] Leucine [ ] Glutamate [ ] Valine

18. The most common method of determination of amino acid composition of an enzyme
[ ] Acid hydrolysis [ ] Alkaline hydrolysis
[ ] Edman degradation [ ] Sangers' method

19. What is the significance of reversible covalent modification in enzyme regulation?
[ ] Uncontrolled response to metabolic circumstances
[ ] Rapid change in active enzyme amount
[ ] Irreversible modification
[ ] No change in enzyme activity

20. In metabolic pathways regulation, what type of kinetic behavior is typically observed in enzymes of this kind?
[ ] Hyperbolic [ ] Sigmoidal [ ] Linear [ ] Exponential

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blanks

21. Sephadex G-100 can fractionate the globular proteins in the molecular weight range of _____ kDa.

22. An example of an enzyme that follows acid-base catalysis is _____.

23. The Enzyme Commission (EC) number for enzyme nomenclature consists of _____ numbers.

24. The value of _____ is sometimes referred to as the turnover number for the enzyme.

25. In Edman Degradation, the useful upper limit is around _____ cycle of degradation.

26. In _____ effect, binding the substrate molecule within the enzyme active site contribute to enzyme assisted rate acceleration.

27. Many enzymes require a non-protein component for activity termed as a _____.

28. During the enzymatic action of chymotrypsin, the amino acid residue that helps transform water into hydroxide ion is _____.

29. An enzyme is least soluble at its _____ point.

30. Enzyme works by_____ the activation energy of the reaction.

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SECTION "C"
[3 Q. × 8 = 24 marks]

Attempt *ANY THREE* questions.

1. Derive the Michaelis—Menten equation from steady state model of enzyme kinetics.

2. Differentiate between Competitive and Noncompetitive inhibition with examples. Explain the techniques to identify them with Lineweaver Burk plots

3. Explain the mechanism of enzymatic action of Chymotrypsin.

4. Explain the strategy and methods for the purification of adenylate kinase from pig muscle.

SECTION "D"
[31 marks]

Attempt *ANY SIX* questions. **(Q.N. 5. is compulsory)**

5. Write short notes on [2×3=6]
   a. Metabolic pathways regulation
   b. Sources of Enzymes

6. List the different classes of enzymes with an example of each class [5]

7. Explain Edman Degradation method for the determination of amino acid sequence of an enzyme. [5]

8. Explain how kinetic parameters (K_m and V_{max}) can be determined using Lineweaver-Burk plots [5]

9. Explain the significance of Michaelis constant (K_m) in the study of enzyme kinetics. [5]

10. Explain the regulation /control of enzyme activity by changes in covalent structure of enzyme with an example. [5]

11. List out some of the methods for the determination of molecular weight of an enzyme. Explain any one of the methods. [5]