BRAINWARE UNIVERSITY

Term End Examination 2023-2024
Programme – M.Sc.(BT)-2022
Course Name – Enzymology
Course Code - MBTE306
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Select the organic molecule that you will NOT add in the growth medium for amylase production by micro-organisms

a) Starch
b) Peptone
c) Sodium citrate
d) Glucose

(ii) Decide the purpose of fusing enzymes with other proteins or domains in enzyme optimization.

a) To decrease enzyme activity
b) To reduce enzyme stability
c) To improve enzyme targeting or stability
d) To alter enzyme structure

(iii) Choose the correct alternative: In some cases, the genetic code of an enzyme can be optimized for expression in specific _____ to increase production yields.

a) Industrial processes
b) Temperature ranges
c) Host organisms
d) pH levels

(iv) Determine the assumption that is made when using the Michaelis-Menten equation

a) Enzyme concentration is greater than substrate concentration
b) The reaction is irreversible
c) The enzyme-substrate complex is in rapid equilibrium
d) Multiple substrates are involved

(v) Deduce the main feature of un-competitive inhibition

a) The inhibitor competes with the substrate for the active site.
b) The inhibitor binds only to the ES complex.
c) The inhibitor binds covalently to the enzyme.
d) The inhibitor forms a particularly stable non-covalent association.

(vi) You have initiated a start-up company that generates a lot of hemi-cellulosic waste. Select the enzyme that you will use for cleaning the waste generated from your company

a) Xylanase
b) Urease
c) Pullulanase
d) Lipase

(vii) Classify the enzyme type that specifically acts on molecules with similar functional groups

a) Group-specific enzyme
b) Regio-selective enzyme
c) Anomer-specific enzyme
d) All of the above

(viii) Predict the process that contributes to the regulation of enzymatic activity

a) Covalent modification
b) Allosteric modulation
c) Altered specificity
d) All of the above

(ix) Identify the correct representation of a simple enzymatic reaction involving an enzyme (E), substrate (S), and product (P)

a) $E + S \rightleftharpoons E + P$
b) $E + S \rightarrow EP$
c) $E \rightarrow S + P$
d) $E + P \rightleftharpoons EP$

(x) Determine the factor(s) that contribute to binding energy at the enzyme active site

a) Disulfide bonds
b) Hydrogen bonds
c) Hydrophobic bonds
d) Only b and c

(xi) Recall the enzyme that is critical for photosynthesis

a) Cytochrome Oxidase
b) Pyruvate dehyrogenase
c) RuBP Carboxylase/Oxygenase
d) Histone Transacetylase

(xii) According to the modern notion of enzymatic catalysis, optimal interactions between substrate and enzyme occur only at a certain state. Identify that state.

a) In the ground state
b) In the product state
c) In the transition state
d) In the equilibrium state

(xiii) Identify that Non-Catalytic Functions (NCFs) in enzyme immobilization relate to-

a) The biological activities of enzymes
b) The physical properties of the immobilized enzyme
c) The optimal pH and temperature range for enzymes
d) The concentration of substrates

(xiv) Identify the immobilization method that may alter the conformational structure and active center of enzymes

a) Physical adsorption
b) Covalent binding
c) Cross-linking
d) Entrapment

(xv) Recall one of the main advantages of immobilized enzymes

a) They are challenging to separate from the reaction mixture.
b) They are single-use and cannot be reused.
c) They provide easy separation from the reaction mixture and can be reused for multiple cycles.
d) They are more sensitive to process conditions than free enzymes.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Write down the Michaelis Menten equation and interpret each of its components. Illustrate the same graphically. (3)
3. Discuss a generalized mechanism of enzyme catalysis involving two or more substrates. (3)
4. Describe the concept of isoelectric focusing and its significance in protein analysis. How does it differ from two-dimensional electrophoresis? (3)
5. Evaluate the role of catabolite repression in optimal amylase production. (3)
6. Illustrate the Zwitter ionic form of an enzyme with proper diagram (3)

OR

You have discovered and sequenced an enzyme, and found that this enzyme is rich in Lysine and Arginine residues. Mention whether this enzyme will exist as cation or anion under physiological pH. Explain your answer with suitable reasons. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Restate the factors that make neutral proteases unsuitable for industrial applications. (5)
8. Derive the Lineweaver-Burk plot from the Michaelis-Menten equation. Mention the purpose of double reciprocal plot. (5)
9. Critically evaluate the enzyme inhibitors that are widely used for pharmacological purposes, highlighting the mode of action of each and providing examples. (5)
10. Describe the concept of activation energy in enzymatic reactions. How do enzymes lower the activation energy of reactions? (5)
11. Explain the essential roles of CoA in biochemical reactions. (5)
12. (i) Estimate the substrate concentration for an enzyme with Kcat= 30 s-1 and Km= 0.0050 M to operate at V0= 1/4th of Vmax. (ii) Predict the fraction of Vmax that would be obtained at the following substrate concentrations: [S]= 1/2 Km, 2 Km, 10 Km. (5)

OR

Justify the induced fit model for explaining enzyme specificity and catalysis, with the help of an example (5)

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