BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Sc.(BT)-2022/M.Sc.(BT)-2023
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) Predict the molecule that is often the precursor of coenzymes

a) Minerals b) Nucleotides
c) Fatty acids d) Vitamins

(ii) Choose the EC number of Hexokinase

a) 1 b) 6
c) 3 d) 2

(iii) Recall the step in enzyme isolation and purification that uses ammonium sulfate precipitation and organic solvent extraction

a) Cell Disruption b) Fractionation
c) Crystallization d) Characterization

(iv) A person is suffering from pancreatic carcinoma. Determine the serum enzyme that will be taken as a preferable bio-marker for assessing the extent of this disease

a) Aldolase b) Iso-citrate dehydrogenase
c) Lipase d) SGOT

(v) Select the correct phenomenon which takes place when an enzyme is kept in a dilute solution of mineral salt

a) Isoelectric precipitation b) Salting out
c) Salting in d) None of these

(vi) Identify the primary use of the Michaelis-Menten equation in drug development

a) To determine the chemical structure of drugs b) To optimize drug dosage and design
c) To identify drug targets d) To study drug side effects

(vii) Identify from the following options the primary role of regulatory enzymes in cellular metabolism

a) Catalysing the final step of metabolic pathways b) Initiating metabolic reactions

c) Adjusting the rate of entire metabolic sequences
d) Converting substrates into products

(viii) Cite the term that is used to describe the regulation mechanism where the end product of a pathway inhibits the first enzyme in that pathway

a) Feedback inhibition
b) Proteolytic cleavage
c) Allosteric activation
d) Covalent modification

(ix) Cytochrome P450 enzymes are known for their selectivity in oxidizing only specific positions of organic molecules. Infer the type of selectivity displayed here

a) Chemical specificity
b) Group specificity
c) Regio-specificity
d) Stereochemical specificity

(x) Predict the drug that competitively inhibits HMG-CoA reductase, reducing cholesterol production

a) Cyanide
b) Methotrexate
c) Aspirin
d) Atorvastatin (Lipitor)

(xi) Identify one of the limitations of using enzymes for large-scale industrial applications

a) High operational stability
b) Long shelf-storage life
c) Low cost of isolation and purification
d) Sensitivity to denaturation outside of natural environments

(xii) Cite the type of carrier that is known for its high pressure stability but may undergo abrasion in stirred vessels

a) Inorganic carriers
b) Organic carriers from natural sources
c) Organic synthetic carriers
d) Cellulose derivatives

(xiii) Cite the correct option: Immobilization of enzymes by entrapment method includes-

a) CLEC
b) Inclusion
c) Disulfide bonding
d) None of these

(xiv) Predict the step in site-directed mutagenesis that would involve confirming the presence of desired mutations in the amplified DNA sequence of an enzyme

a) Primer Design
b) PCR Amplification
c) Dideoxy Sequencing
d) Transformation

(xv) TPP is essential for the enzymatic conversion of glyoxylate to glycine and serine. Deduce the derivative of TPP involved in this reaction

a) THPP
b) PPH
c) FADH2
d) TLP

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain the significance of energy barrier in enzymatic reactions. Illustrate with the help of a diagram how it relates to the activation energy and transition state. (3)
3. Describe the Michaelis-Menten equation for competitive inhibition.Interpret what αKm represent and how it change in the presence of an inhibitor. (3)
4. Summarize the characteristics of an ideal carrier used for enzyme immobilization in industrial set-ups. (3)
5. Analyze the role of cellulase in biofuel production. (3)
6. Schematically summarize all the enzymes that are used for optimal industrial production of starch-based sweeteners. (3)

OR

Evaluate the nature and types of enzymes used in textile industry. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Derive the Lineweaver-Burk plot from the Michaelis-Menten equation. Mention the purpose of double reciprocal plot. (5)
8. Illustrate with examples the covalent binding method of enzyme immobilization. What are its advantages and disadvantages? (5)
9. Define and illustrate a coupled assay. (5)
10. Infer in your own words the characteristics of mixed inhibition and its effects on both Km and Vmax. (5)
11. (5)

[S] (M)	V_0 (μM/min)
2.5×10^{-6}	28
4.0×10^{-6}	40
1×10^{-5}	70
2×10^{-5}	95
4×10^{-5}	112
1×10^{-4}	128
2×10^{-3}	139
1×10^{-2}	140

Estimate the Vmax and Km of the enzyme-catalyzed reaction for which the following data were obtained:

12. Schematically summarize the steps involved in site-directed mutagenesis for obtaining an industrially-optimized enzyme. (5)

OR

Critically evaluate the application of enzymes for optimal waste treatment. (5)

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