Written Answers

1. (a) If the $K_M$ of an enzyme for its substrate remains constant as the concentration of the inhibitor increases, what can be said about the mode of inhibition?

(b) The kinetic data for an enzymatic reaction in the presence and absence of inhibitors are plotted in the figure. Identify the curve that corresponds to each of the following.

(i) No inhibitor

(ii) Noncompetitive inhibitor

(iii) Competitive inhibitor

(iv) Mixed inhibitor

(c) Draw approximate Lineweaver-Burk plots for each of the inhibitor types in Question (b)
2. (a) Draw the structure of
   (i) a typical triacyl glycerol

   (ii) a sphingomyelin

   (iii) cholesterol
2. (b) Briefly describe, using diagrams where appropriate, the posttranslational processing of integral membrane proteins in the endoplasmic reticulum and Golgi apparatus that results in the glycosylated protein being incorporated into a plasma membrane with the glycosylated region being oriented properly.
2(c) The following diagram represents the protein glycophorin which traverses the red cell membrane. Indicate on the diagram where you would expect to find

i) predominantly hydrophobic amino acids
ii) predominantly hydrophilic amino acids
iii) carbohydrate attachments
2(d) Explain briefly and clearly how and why the following changes in the components of membranes would affect the fluidity of the membrane.

(i) An increase in the proportion of saturated fatty acid components of phospholipids

(ii) A decrease in the percentage of cholesterol

(iii) Suggest why the lipid components of a lipid bilayer can readily move laterally in a membrane but are restricted in a flip/flop motion across the membrane.
Multiple Choice

1. Which of the following statements about the different types of enzyme inhibition are correct?
   
   (i) Competitive inhibition is seen when a substrate competes with an enzyme for binding to an inhibitor protein.
   (ii) Competitive inhibition is seen when the substrate and the inhibitor compete for the active site on the enzyme.
   (iii) Noncompetitive inhibition of an enzyme cannot be overcome by adding large amounts of substrate.
   (iv) Competitive inhibitors are often similar in chemical structure to the substrates of the inhibited enzyme.
   (v) Noncompetitive inhibitors often bind to the enzyme irreversibly.

   a. (i) and (iv)
   b. (i), (iii) and (v)
   c. (iii), (iv), and (v)
   d. (ii), (iii), and (iv)
   e. (ii) and (iv)
2. What is the best classification for the lipid structure below:

- f. triacylglycerol
- g. glycerophospholipid
- h. phosphosphingolipid
- i. glycosphingolipid

3. The vitamins that are converted into coenzymes that participate in oxidation-reduction reactions are

- j. nicotinamide and riboflavin
- k. vitamin C and biotin
- l. biotin and nicotinamide
- m. thiamine and riboflavin
- n. thiamin and biotin

4. An enzyme catalyzes a reaction at a velocity of 50 µmol/min when the concentration of substrate is 0.05 M. The \( K_m \) for this substrate is 1 µM. Assuming that Michaelis-Menten kinetics are followed, what will the reaction velocity be when the concentration of substrate is 1 µM?

1. 25 µmol/min
2. 50 µmol/min
3. 100 µmol/min
4. 1.0 µM
5. 0.5 µM
5. Which of the following molecules or substances contain, or are derived from, fatty acids?

(a) prostaglandins  
(b) beeswax  
(c) triacylglycerols  
(d) sphingolipids  
(e) All of the above are derived from fatty acids

6. Which of the following structures is most likely to be an effective inhibitor of the enzyme proline racemase, which catalyzes the reaction below.

\[
\text{L-Proline} \xrightarrow{H^+} \text{Planar transition state} \xrightarrow{H^+} \text{D-Proline}
\]
7. At saturating concentrations of substrate, a reaction catalyzed by an allosteric enzyme is (with respect to substrate)

(a) zero order
(b) first order
(c) second order
(d) third order
(e) mixed order

8. Sugar residues of glycolipids are usually

(a) located on the internal surface of mammalian plasma membranes
(b) sandwiched between the hydrocarbon tails of membrane bilayers
(c) located on the external surface of mammalian plasma membranes
(d) both (a) and (c)
(e) none of the above
9. Isocitrate dehydrogenase catalyzes the reaction

\[
\text{Isocitrate} + \text{NAD}^+ \rightarrow \alpha\text{-ketoglutarate} + \text{CO}_2 + \text{NADH} + \text{H}^+ 
\]

The curves illustrated below are obtained when the initial velocity \((v)\) of the reaction is plotted against isocitrate concentration in the presence of various levels of ADP and excess NAD\(^+\). Which of the following statements about this system is correct?

(a) Isocitrate dehydrogenase exhibits simple Michaelis-Menten kinetics in the absence of ADP.
(b) ADP increases the \(K_m\) of the enzyme for isocitrate.
(c) ADP increases the \(V_m\) of the enzyme.
(d) ADP activates the enzyme.
10. A defective enzyme was purified from a tissue sample obtained from an infant. The kinetic properties of this enzyme were compared with those of the enzyme isolated from a normal individual and the data shown in the graph above were obtained. Which of the following statements is (are) true?

6. Both enzymes have the same $V_m$.
7. A higher concentration of thiamine pyrophosphate (TPP) is required to saturate the patient's enzyme.
8. The patient's enzyme has a $K_m$ for thiamine pyrophosphate that is 5 times that for the normal enzyme.
9. Administration of thiamine to the patient would result in a greater proportion of the enzyme in the active enzyme-TPP complex.
10. All of the above are true