

生命科學系生物醫學碩士班生物化學考題共 4 頁

A. Multiple Choices (共 15 題，30 分，每題 2 分; one correct answer only)

1. If you wanted to describe K_m to a person who had little biochemical background, you could tell them to think of it as:
 - A. Half the maximum velocity of the saturated enzyme
 - B. Half the activation energy
 - C. Substrate concentration
 - D. The substrate concentration which produces half the maximum velocity
 - E. The way the substrate fits an inhibitor
2. Many of the reactions that occur in our body require energy. This means that the ΔG of life appears to be positive and thus, the reactions are unfavorable and shouldn't occur. How is it that life still occurs?
 - A. Unfavorable reactions (+ ΔG) are coupled with favorable reactions (- ΔG).
 - B. All reactions that occur within the body have a - ΔG .
 - C. In the body, enzymes catalyze reactions that have a + ΔG .
 - D. There are no energy requiring processes within the body.
 - E. All reactions in the body are catabolic.
3. The presence of a certain enzyme inhibitor increased the K_m of the enzyme but did not lower the maximum velocity. The inhibitor was:
 - A. An enzyme poison
 - B. A competitive inhibitor
 - C. A noncompetitive inhibitor
 - D. An uncompetitive inhibitor
 - E. An enzyme activator
4. The zwitterion form of alanine:
 - A. Is the form which exists in a solution having a pH of 7.0
 - B. Is the form which has no charges whatsoever
 - C. Is the form present in acidic solution
 - D. Is the form you'd find in basic solutions
 - E. Has a charge of -1
5. The easiest way to determine whether a biomolecule is being oxidized during a reaction is to:
 - A. Check for a change in redox potential by using a pH meter
 - B. Look for a change in the charge of the ions
 - C. Watch for addition or removal of sulfur
 - D. Look for an addition or removal of hydrogen or oxygen
 - E. Watch for formation of a dimer or trimer
6. Hemoglobin is made up of two α chains and two β chains. The maximum degree of protein structure shown by hemoglobin is:
 - A. Quaternary
 - B. Primary
 - C. Tertiary
 - D. Secondary
 - E. Nonpolar

7. A small molecule that *decreases* the activity of an enzyme by binding to a site other than the catalytic site is termed a(n):
- A. alternative inhibitor.
 - B. allosteric inhibitor.
 - C. stereospecific agent.
 - D. competitive inhibitor.
 - E. transition-state analog.
8. The Bohr effect describes the affect of pH on binding of oxygen by hemoglobin. In general, this effect:
- A. Provides a mechanism by which hemoglobin binds oxygen tightly in the presence of carbonic acid in muscles
 - B. Provides an explanation for the release of oxygen at high pH in lung tissue
 - C. Provides a mechanism for the binding of hemoglobin and oxygen at low pH in lung
 - D. Provides an explanation for the release of oxygen at low pH in muscle tissue
 - E. Provides a link between oxygen consumption and respiration
9. A peptide was found to have a molecular mass of about 650 and upon hydrolysis produced Ala, Cys, Lys, Phe, and Val in a 1:1:1:1:1 ratio. The peptide upon treatment with Sanger's reagent produced DNP-Cys and exposure to carboxypeptidase produced valine. Chymotrypsin treatment of the peptide produced a dipeptide that contained sulfur and has a UV absorbance, and a tripeptide. Exposure of the peptide to trypsin produced a dipeptide and a tripeptide. Deduce the sequence of the peptide.
- A. Val-Ala-Lys-Phe-Cys
 - B. Cys-Lys-Phe-Ala-Val
 - C. Cys-Ala-Lys-Phe-Val
 - D. Cys-Phe-Lys-Ala-Val
 - E. Val-Phe-Lys-Ala-Cys
10. Prions are dangerous proteins which act as the infectious agents for mad cow disease (bovine spongiform encephalitis) and similar human diseases such as Kreutzfeld-Jacob Disease. Prions are especially dangerous because they are resistant to:
- A. Attack by microorganisms
 - B. Denaturation by heating
 - C. Denaturation by basic hydrolysis
 - D. Digestion by microorganisms
 - E. Isolation and examination
11. The most *accurate* value of a protein's molecular weight would come from
- A. SDS-PAGE
 - B. ELISA
 - C. Amino Acid Analysis
 - D. Gel Filtration
 - E. MALDI-TOF
12. A solution having a pH of 5 would have this many times as much hydrogen ion concentration as a solution having a pH of 8:
- A. 10
 - B. 100
 - C. 1000
 - D. 10000
 - E. 100000
13. On the x and y axes of a Lineweaver-Burk plot, the largest values of substrate concentration will be found:
- A. At the top of the y axis
 - B. At the intercept on the y axis
 - C. At the right end of the x axis
 - D. At the intercept on the x axis
 - E. At the origin

14. In a plot of $1/V$ against $1/[S]$ for an enzyme-catalyzed reaction, the presence of a competitive inhibitor will alter the:
- A. V_{\max} .
 - B. intercept on the $1/V$ axis.
 - C. intercept on the $1/[S]$ axis.
 - D. curvature of the plot.
 - E. pK of the plot.
15. Which is true regarding the orientation of the R-groups in β structures?
- A. In the parallel β sheet structures the amino acid R-groups are all on the same side of the sheet.
 - B. In the antiparallel β sheet structure the R-groups on alternate strands are on the same side of the sheet.
 - C. In parallel and antiparallel sheets consecutive R-groups on each peptide strand alternate sides of the sheet.
 - D. Because of the free rotation around the α carbon, the R-groups can seek the least crowded region and are not restricted to a specific side of the sheet.
 - E. A and B

B. Essay (共 11 題, 70分)

1. **In lab you are trying to purify a new enzyme. After a simple salt precipitation step you find your protein contains two contaminants. One contaminant has a molecular weight similar to the enzyme you are trying to purify, but a pI that is two units higher. The second contaminant has a pI that is almost identical to your enzyme, but has a molecular weight that is four times larger than the enzyme's. What further purification steps would you suggest and why? (10%)**
2. **Epinephrine acts on muscles, activates the activity of cAMP-dependent protein kinase and stimulates glycolysis. However, glucagon acts on the liver and also activates the activity of cAMP-dependent protein kinase, but blocks glycolysis. Why? (6%)**
3. **Why can ketone bodies be formed during fasting? (6%)**
4. **Adenosine deaminase deficiency can lead to severe immunodeficiency disease. Why? (6%)**
5. **Cytochrome c plays two distinct and very important roles in mammalian cells: (1) in the mitochondrial electron transport chain, and (2) in apoptotic cell death. Describe the roles of cytochrome c in these two processes. (6%)**
6. **Describe two roles of phosphatidylinositol 4,5-bisphosphate (PIP_2) in signal transduction (6%)**
7. **The citric acid cycle begins with the condensation of acetyl-CoA with oxaloacetate. Describe three possible sources for the acetyl-CoA. (6%)**
8. **Why is it more efficient to store energy as lipid rather than as glycogen? (6%)**

- 9. List the processes for two different ser/thr protein kinases that are inactive in the cytosol and are activated after targeted onto the membrane. (6%)**

- 10. In type I diabetes mellitus, glucose uptake into myocytes and adipocytes is failed. Why? (6%)**

- 11. How does blood glucose regulate insulin secretion of pancreatic β cells? (6%)**