

生命科學系分子生物碩士班生物化學考題共 3 頁

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

1. What is the pH of an aqueous solution that has a  $[\text{OH}^-]$  of  $3.45 \times 10^{-5} \text{ M}$ ?  
A. 3.47                      B. 4.47                      C. 5.53  
D. 9.54                      E. none of the above
2. The  $K_m$  is:  
A. The time for half of the substrate to be converted to product.  
B. The time for all of the substrate to be converted to product.  
C. The  $[\text{S}]$  that gives half of the maximum reaction rate.  
D. The  $[\text{S}]$  that gives the maximum reaction rate.  
E. The  $[\text{P}]$  that is produced when the enzyme is saturated with the substrate.
3. An enzyme in liver which removes glucose from blood has a high  $K_m$ ; another which does the same thing in brain tissue has a small  $K_m$ . The usefulness of these two different values is that:  
A. The enzyme in brain tissue can take glucose from the blood stream even when levels are low, and the enzyme in liver will not take glucose from blood unless levels are high  
B. The enzyme in brain tissue can take glucose from the blood stream only when levels are high, and the enzyme in liver will not take glucose from blood unless levels are low  
C. The enzyme in brain tissue can take glucose from the blood stream only when levels are high, and the enzyme in liver will not take glucose from blood at any time  
D. This phenomenon is of no apparent value to the organism  
E. It is actually dangerous for the organism; ideally, both  $K_m$ 's should be high
4. A mixture of urease ( $pI = 5.1$ , mol. wt. 482,700), catalase ( $pI = 5.6$ , mol. wt. 247,500), lactoglobulin ( $pI = 5.2$ , mol. wt. 37,100) and hemoglobin ( $pI = 6.9$ , mol. wt. 64,500) were applied in a pH 6.5 buffer to a DEAE-cellulose chromatography column and eluted with the same buffer. What was their order of elution?  
A. urease, lactoglobulin, catalase, hemoglobin              B. hemoglobin, catalase, lactoglobulin, urease  
C. urease, catalase, hemoglobin, lactoglobulin              D. lactoglobulin, hemoglobin, catalase, urease  
E. cannot be determined from the information given
5. Under physiological conditions, which of the following processes is not an important method for regulating the activity of enzymes?  
A. Phosphorylation.                      B. Temperature changes.                      C. Adenyl addition.  
D. Disulfide reduction.                      E. Partial proteolysis.
6. Which of the following would allow you to determine the isoelectric point of a protein?  
A. protein quaternary structure                      B. protein solubility as a function of pH  
C. protein size                      D. protein shape  
E. protein tertiary structure
7. What allosteric regulator of hemoglobin makes  $\text{O}_2$  bind more tightly?  
A. BPG              B.  $\text{Cl}^-$               C.  $\text{O}_2$               D. Carbamate              E.  $\text{H}^+$

8.  $G^\circ$  for the conversion of glycerol-3-phosphate to glycerol + Pi is -2.2 kcal/mole. Thus, you can conclude that
- A. this reaction will occur spontaneously.
  - B. this reaction may or may not occur spontaneously, depending on the actual concentrations of reactants and products.
  - C. this reaction will only occur spontaneously if it is coupled to another reaction that has a more favorable  $G^\circ$ .
  - D. this reaction is so strongly favorable that it could be coupled to drive an otherwise unfavorable cell reaction.
9. The fact that allosteric enzymes are remarkably sensitive to control makes them ideal candidates for:
- A. The initial steps in a pathway
  - B. The rate-limiting steps in a pathway
  - C. The final steps in a pathway
  - D. All the steps in a pathway
  - E. Alternative pathways
10. An enzyme which has a high turnover number:
- A. Can easily be denatured
  - B. Can easily be replaced with another enzyme
  - C. Needs a constant supply of cofactors
  - D. Converts substrate to product very rapidly
  - E. Can be easily controlled
11. The chirality of an amino acid results from the fact that its  $\alpha$  carbon:
- A. is a carboxylic acid.
  - B. is bonded to four different chemical groups.
  - C. is symmetric.
  - D. is in the L absolute configuration in naturally occurring proteins.
  - E. has no net charge.
12. In the  $\alpha$  helix the hydrogen bonds:
- A. are perpendicular to the axis of the helix.
  - B. occur mainly between electronegative atoms of the R groups.
  - C. occur mainly between electronegative atoms of the backbone.
  - D. occur only between some of the amino acids of the helix.
  - E. occur only near the amino and carboxyl termini of the helix.
13. Treatment of one mole of glutamic acid with a mole of sodium hydroxide forms monosodium glutamate, a meat tenderizer sometimes known as MSG. If you added one mole of glutamic acid to one mole of sodium hydroxide, the glutamic acid would react first:
- A. At its amine group
  - B. At the -COOH group having the highest pK
  - C. At the -COOH group having the lowest pK
  - D. At both the -COOH groups at the same time
  - E. At both of the amine and -COOH groups closest to each other
14. 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

15. During a typical trip to the beauty parlor, a person may have his or her hair curled. This treatment involves using a reducing agent, followed by an oxidizing agent. The type of bonds being reduced are probably:
- A. Peptide bonds                                      B. Hydrogen bonds                                      C. Ionic bonds  
D. Covalent bonds                                      E. Disulfide bonds

**B. Essay (共 11 題, 70分)**

- 1. List at least 2 different ways to determine the molecular weight of a protein, and give a brief description of how the method works. (10%)**
- 2. Epinephrine acts on muscles and stimulates glycolysis. However, epinephrine blocks glycolysis when it acts on the liver. Why? (6%)**
- 3. Glucagon binds to its receptor on the membrane of adipocytes and triggers mobilization of stored triacylglycerols. Give the mechanism for this pathway. (6%)**
- 4. As intermediates of the citric acid cycle are removed to serve as biosynthetic precursors, they are replenished by anaplerotic reactions. List the most common anaplerotic reactions. (6%)**
- 5. Describe the main function of the pentose phosphate pathway (6%)**
- 6. Why can aspirin be used for an anti-inflammatory drug and reduce the probability of heart attacks? (6%)**
- 7. Why can RFLPs and STRs be used in forensic DNA fingerprinting technology? (6%)**
- 8. How does adipose tissue generate glycerol 3-phosphate during starvation? (6%)**
- 9. Give two routes for production of NADPH in mammals. (6%)**
- 10. How does the chemotherapeutic agent (fluorouracil) inhibit the biosynthesis of dTMP in mammals? (6%)**
- 11. Either allosteric control of enzyme activity or enzyme induction/repression can be used to regulate the metabolic rates of cells. Which control mechanism should be the most useful to adjust to rapid changes in conditions? Explain your answer. (6%)**