

國立中正大學 109 學年度碩士班招生考試試題

科目名稱：生物化學

本科目共 4 頁 第 1 頁

系所組別：生物醫學科學系生物醫學

**A. Multiple Choices (50%, 2% each; one correct answer only)**

- The presence of a certain enzyme inhibitor increased the  $K_m$  of the enzyme but did not lower the maximum velocity. The inhibitor was:
  - An enzyme poison
  - A competitive inhibitor
  - A noncompetitive inhibitor
  - An uncompetitive inhibitor
  - An enzyme activator
- On the x and y axes of a Lineweaver-Burk plot, the largest values of substrate concentration will be found:
  - At the top of the y axis
  - At the intercept on the y axis
  - At the right end of the x axis
  - At the intercept on the x axis
  - At the origin
- 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.
  - Val-Ala-Lys-Phe-Cys
  - Cys-Lys-Phe-Ala-Val
  - Cys-Ala-Lys-Phe-Val
  - Cys-Phe-Lys-Ala-Val
  - Val-Phe-Lys-Ala-Cys
- Hydrophobicity profile of a protein can be calculated from its \_\_\_\_\_ protein structure.
  - primary
  - secondary
  - tertiary
  - Quaternary
- Allosteric inhibition of an enzyme involves which of the following?
  - Binding of an inhibitor to a site other than the substrate binding site
  - Binding of an inhibitor competitively to the substrate binding site
  - Binding of an inhibitor noncompetitively to the substrate binding site
  - Cooperative binding of substrate to an enzyme with four or more subunits
  - Cooperative binding of substrate to an enzyme that does not deviate from normal Michaelis-Menten kinetics
- The chirality of an amino acid results from the fact that its  $\alpha$ -carbon
  - is a carboxylic acid.
  - is bonded to four different chemical groups
  - is symmetric.
  - has no net charge
  - is in the L absolute configuration in naturally occurring proteins
- An enzyme which has a high turnover number:
  - Can easily be denatured
  - Can easily be replaced with another enzyme
  - Needs a constant supply of cofactors
  - Converts substrate to product very rapidly
  - Can be easily controlled

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本科目共 4 頁 第 2 頁

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8. 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 [S] that gives half of the maximum reaction rate.
  - D. The [S] that gives the maximum reaction rate.
  - E. The [P] that is produced when the enzyme is saturated with the substrate.
9. Which of the following protein-modifying reagents specifically cleaves polypeptides on the carboxyl side of methionine residues
- A. Chymotrypsin
  - B. Cyanogen bromide
  - C. Iodoacetamide
  - D. Phenylglyoxal
  - E. Pyridoxal 5'-phosphate
10. Which three cellular components are present in both prokaryotes and eukaryotes?
- A. ribosomes, chloroplasts, mitochondria
  - B. nucleus, ribosomes, RNA
  - C. RNA, DNA, ribosomes
  - D. endoplasmic reticulum, DNA, RNA
  - E. mitochondria, DNA, RNA
11. Enzymes accelerate biochemical reactions by
- A. decreasing the  $\Delta G$  for the reactions.
  - B. increasing the  $\Delta G$  for the reactions.
  - C. establishing a 'closed system' for each reaction.
  - D. promoting reaction pathways associated with a positive  $\Delta G$ .
  - E. providing a more favorable pathway for the reactions.
12. Fatty acids such as palmitate and oleate are usually characterized as
- A. hydrophobic.
  - B. hydrophilic.
  - C. polar.
  - D. water soluble.
  - E. amphiphilic.
13. The pH of coffee is 5.6. The pH of grapefruit juice is 2.6. This means that the proton concentration in coffee is
- A. a thousand times higher than in grapefruit juice.
  - B. a thousand times lower than in grapefruit juice.
  - C. 3000 times lower than in grapefruit juice.
  - D. 3 times the proton concentration of grapefruit juice.
  - E. 3000 times higher than in grapefruit juice.
14. Which of the following statements about nucleotides is false?
- A. Nucleotides mediate transport of energy within the cell.
  - B. Nucleotides are involved in oxidation-reduction reactions.
  - C. Nucleotides store genetic information.
  - D. Nucleotides are involved in biosynthetic reactions.
  - E. none of the above

國立中正大學 109 學年度碩士班招生考試試題

科目名稱：生物化學

本科目共 4 頁 第 3 頁

系所組別：生物醫學科學系生物醫學

15. Nucleoside triphosphates carry energy in the form of  
A. glycosidic bonds  
B. phosphoester bonds  
C. phosphoanhydride bonds  
D. hydrogen bonds  
E. amide linkages
16. The Watson and Crick model of a double-helical structure for DNA was based, in part, on evidence from  
A. NMR (nuclear magnetic resonance) spectroscopy.  
B. IR (infrared) spectroscopy.  
C. atomic force microscopy.  
D. electron microscopy.  
E. X-ray diffraction.
17. Which amino acid does not have a primary  $\alpha$ -amino group?  
A. glutamine  
B. arginine  
C. lysine  
D. proline  
E. Glutamate
18. Which of the following amino acids has a charged polar side chain at pH 7.0?  
A. Leu  
B. Ala  
C. Met  
D. Trp  
E. Glu
19. Which of the following has the most dramatic influence on the characteristics of an individual protein?  
A. the amino-acid sequence  
B. the amino-acid composition  
C. the location of its encoding gene within the genome  
D. the stereochemistry at the  $\alpha$ -carbon  
E. the sequence of tRNA molecules involved in its translation
20. The quantitation of proteins due to their absorbance at  $\sim 280$  nm (UV region) is due to the large absorptivity of the \_\_\_\_\_ amino acids.  
A. anionic  
B. dansylated  
C. cleaved  
D. polar  
E. aromatic
21. A technique that can be used to separate proteins based primarily on their  $pI$  is called  
A. ion-exchange chromatography.  
B. gel filtration chromatography.  
C. affinity chromatography.  
D. isoelectric focusing.  
E. hydrophobic interaction chromatography.
22. You are trying to separate five proteins, which are listed below, by gel filtration chromatography. Which of the proteins will elute first from the column?  
A. cytochrome c (12 kDa)  
B. RNA polymerase (99 kDa)  
C. glutamine synthetase (621 kDa)  
D. interferon- $\alpha$  (34 kDa)  
E. hemoglobin (62 kDa)
23. For  $\beta$ -sheets, the terms 'parallel' and 'antiparallel' refer to \_\_\_\_\_.  
A. the 'direction' of the associated peptide strands  
B. the orientation of the amide cross-links  
C. the quaternary structure of the protein  
D. the orientation of the hydrogen bonding  
E. the topology of the reverse turns

國立中正大學 109 學年度碩士班招生考試試題

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24. In two homologous proteins, which residue is most likely to replace a Glu residue as a conservative substitution?

- A. Asp                      B. Trp                      C. Met                      D. Ile                      E. Lys

25. A chaperonin

- A. helps fold some proteins in their lowest energy state.  
B. is required for all proteins to fold properly.                      C. mediates the unfolding of proteins.  
D. is required for protein denaturation.                      E. counteracts the laws of thermodynamics.

**B. Essay (50%)**

1. Animals cannot convert fatty acids to glucose. Why? (5%)

2. Describe the functions of mitochondria. (5%)

3. Give the cellular location for the following molecules:

- (a) IP3 receptor (1%)                      (b) PKC after activation. (1%)                      (c) adenylyate cyclase (1%)  
(d) Ras (1%)                      (e) ATP synthase (1%)

4. Several pathways may be activated by a single type of receptor. How then does a cell prevent inappropriate cross-talk between closely related signaling pathways? (5%)

5. Draw the structure of the following compounds:

- (a) glycine (1%)                      (b) phenylalanine (1%)                      (c) linoleic acid (1%)  
(d) serine (1%)                      (e) tyrosine (1%)

6. Describe the fates of pyruvate in mammals under aerobic and anaerobic conditions. (5%)

7. Show the reactions by which  $\alpha$ -ketoglutarate is converted to malate in the citric acid cycle. (5%)

8. Degradation of odd-chain fatty acids can increase the activity of the citric acid cycle. Why? (5%)

9. Describe the compositions of LDL. (5%)

10. During starvation, more urea production occurs. Why? (5%)