

國立中正大學 108 學年度碩士班招生考試試題

科目名稱：生物化學

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系所組別：生物醫學科學系生物醫學

I. Multiple Choice (2% each, total 50%, choose the best answer)

- Ubiquitination of proteins modifies the side chain of _____ residue.
A) Asn B) Lys C) Arg D) Cys E) Ser
- Which amino acid does not have a primary α -amino group?
A) glutamine B) arginine C) lysine D) proline E) glutamate
- Which of the following explains why enzymes are extremely effective catalysts?
A) an enzyme stabilizes the transition state
B) enzymes bind very tightly to substrates
C) enzymes release products very rapidly
D) an enzyme can convert a normally endergonic reaction into an exergonic reaction
E) an enzyme lowers the energy of activation only for the forward reaction
- What are the expected changes in kinetics in the presence of a competitive inhibitor?
A) V_{max} decreases, K_M appears to decrease B) V_{max} does not change, K_M appears to decrease
C) V_{max} decreases, K_M appears to increase D) V_{max} does not change, K_M appears to increase
E) V_{max} decreases, K_M does not change.
- 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
- 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.
- What is the pH of an aqueous solution that has a $[OH^-]$ of 3.45×10^{-5} M?
A) 3.47 B) 4.47 C) 5.53
D) 9.54 E) none of the above
- 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

16. In glycoproteins, the carbohydrate moiety always gets attached through which of the following amino acids?
- A) Glycine or alanine B) Tryptophan or phenylalanine C) Aspartate or glutamate
D) Glutamine or arginine E) Asparagine, serine, or threonine
17. Which of the following is an example of tertiary structure in a protein?
- A) A multimeric protein B) An α -helix C) A β -pleated sheet D) A globular domain
18. Bisphosphoglycerate (BPG) cannot bind to the oxygenated R state of hemoglobin because
- A) it is displaced from the heme by oxygen
B) it is displaced from the heme by movement of the proximal histidine
C) its binding pocket becomes too small to accommodate BPG
D) BPG binds to the R state with the same affinity as the T state
19. Which of the following segments of the integral membrane protein glycophorin most likely contains the membrane-spanning sequence?
- A) LSTTEVAMHTTTSSSVSKSY B) SQTNDTHKRDTYAATPRA
C) VSEISVRTVYPPEEETGE D) ITLIIFGVMAGVIGTILLI
E) YGIRRLIKKSPSDVKPLP
20. 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 $-\text{COOH}$ group having the highest pK
C) At the $-\text{COOH}$ group having the lowest pK
D) At both the $-\text{COOH}$ groups at the same time
E) At both of the amine and $-\text{COOH}$ groups closest to each other
21. 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.
22. In the α -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.

23. In a protein, the most conformationally restricted amino acid is _____; the least conformationally restricted is _____.
- A) Trp, Gly B) Met, Cys C) Pro, Gly D) Ile, Ala E) Ala, Pro
24. If the reaction $A + B \rightarrow C$ is first order with respect to A and first order with respect to B. Then the rate equation for the forward reaction would be
- A) rate = $k[A]$ B) rate = $k[B]$ C) rate = $k[A][B]$
 D) rate = $k_A + k_B$ E) rate = $k_A[A] + k_B[B]$
25. The chirality of an amino acid results from the fact that its α carbon
- A) is a carboxylic acid. B) is bonded to four different chemical groups
 C) is symmetric. D) has no net charge
 E) is in the L absolute configuration in naturally occurring proteins

II. Essays

- What kind of domain or molecule binds to the following domain?
 (a) SH2 domain (2%) (b) SH3 domain (2%) (c) EF hand (2%)
- Give five (5) amino acid residues that can play biologically important nucleophilic groups in enzymatic catalysis. (5%)
- List three (3) major pathways for glucose utilization. (6%)
- Give the metabolic pathway from glycogen to glucose. (5%)
- Calculate the number of ATP molecules obtained from the anaerobic (無氧狀況) conversion of each of the following compounds to pyruvate in liver:
 (A) Glucose (2%)
 (B) Fructose (2%)
 (C) Lactate (2%)
- List two enzymes that require thiamine pyrophosphate (TPP) in enzymatic catalysis. (4%)
- Explain why compounds such as dinitrophenol (DNP) increase metabolic rates. (6%)

8. Describe the flow of electrons from NADH to O_2 in mitochondria. (6%)

9. Indicate the subcellular location for the following lipid metabolisms in mammals:

(a) Fatty acid synthesis (1%)

(b) Fatty acid elongation (1%)

(c) Fatty acid desaturation (1%)

(d) Phospholipids synthesis (1%)

(e) Ketone body synthesis (1%)

(f) β -oxidation (1%)