

# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所：生物學系

組別：乙組

科目：生物化學

☆☆請在答案紙上作答☆☆

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## Section 1: Multiple choice (2 points for each question)

Please choose **the best answer** for each question.

1. The following lipid vitamin is not a true vitamin  
(A) A (B) D (C) E (D) K
2. These two lipid vitamins are often found in membranes  
(A) A and D (B) A and E (C) D and E (D) E and K
3. The vitamin needed for blood coagulation is  
(A) vitamin A (B) vitamin D (C) vitamin E (D) vitamin K
4. In the fluid mosaic model of membrane structure  
(A) the proteins are specifically bonded to the lipids  
(B) the proteins "float" in the lipid bilayer  
(C) the proteins are sandwiched between the lipid molecules  
(D) the lipids are sandwiched between the protein molecules
5. Facilitated diffusion requires  
(A) a channel protein through which the transported substance passes without binding  
(B) a carrier protein to which the transported substance binds  
(C) a receptor protein  
(D) expenditure of energy by the cell
6. In the operation of the sodium-potassium pump  
(A) conformational changes in membrane proteins are inhibited  
(B) the ions involved bind to the lipid portion of the membrane  
(C) a membrane protein is phosphorylated with ATP as the source of the phosphate group  
(D) a membrane protein is phosphorylated with ADP as the source of the phosphate group
7. An important factor in controlling the level of cholesterol in the bloodstream is the presence of membrane receptors for  
(A) cholesterol (B) cholesterol esters  
(C) atherosclerosis (D) LDL (low density lipoprotein)
8. The vitamin pantothenic acid is involved in this type of reaction  
(A) Carboxylation reactions (B) Decarboxylation reactions  
(C) Redox reactions (D) Acyl transfer reactions

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9. Which of the following can function as coenzymes?  
(A) lead ion, biotin, and lipoic acid  
(B) copper ion, *p*-hydroxymercuribenzoate, diisopropylphosphofluoridate  
(C) zinc ion, pyridoxal phosphate, and nicotinamide adenine nucleotides  
(D) lead ion, *p*-hydroxymercuribenzoate, diisopropylphosphofluoridate
10. Redox reactions often use this cofactor  
(A) Riboflavin (B) Lipoic acid (C) Pyridoxal (D) Thiamine
11. Nicotinamide adenine dinucleotide is  
(A) an enzyme inhibitor used in smoking cessation programs  
(B) an inhibitor of ATP production  
(C) a coenzyme in reactions that transfer acyl groups  
(D) a coenzyme in oxidation-reduction reactions
12. The serine in the active site of chymotrypsin functions as  
(A) a Lewis acid. (B) a metal ion. (C) an electrophile. (D) a nucleophile.
13. Which of the following amino acid side chains would best serve as a general acid, assuming the protein functions at a pH of 7?  
(A) alanine (B) aspartic acid (C) lysine (D) asparagine
14. Which groups of amino acids are likely to be found in the active site of an enzyme?  
(A) leucine, lysine, alanine (B) cysteine, isoleucine, phenylalanine  
(C) tyrosine, threonine, leucine (D) serine, histidine, aspartate
15. In zymogen activation  
(A) only digestive enzymes are involved  
(B) a conformational change takes place with no alteration of primary structure  
(C) an inactive protein is converted to an active one by bond cleavage  
(D) there is aggregation of several enzyme molecules when the substrate binds
16. In the concerted model for allosteric enzymes  
(A) the relative affinities of substrate for the T and R conformations plays an important role in the cooperativity of the reaction  
(B) the equilibrium between the T and R conformations plays a minor role  
(C) the enzymatic activity of the T conformation is considerably higher than that of the R form  
(D) it is possible to describe the reactions of all allosteric enzymes accurately

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17. The main distinguishing feature of the concerted model for the behavior of allosteric enzymes is that
- (A) the conformation of all subunits changes simultaneously
  - (B) it applies only to dimeric enzymes
  - (C) it involves three possible conformations for all subunits
  - (D) the T and R conformations exist in roughly equal amounts
18. In a comparison of allosteric and non-allosteric enzymes
- (A) it is always possible to define a  $K_M$
  - (B) it is always possible to define a  $V_{max}$
  - (C) competitive inhibition is always a possibility
  - (D) much of the terminology is completely unchanged
19. In reactions catalyzed by allosteric enzymes
- (A) substrate, activators, and inhibitors all compete for the same binding site on the enzyme
  - (B) there is no distinction between catalytic and regulatory subunits
  - (C) the presence of an activator makes the plot of reaction rate against substrate concentration less cooperative
  - (D) the presence of an inhibitor makes the plot of reaction rate against substrate concentration less cooperative
20. Allosteric enzymes must exhibit which of the following?
- (A) feedback inhibition
  - (B) a phosphorylation site
  - (C) general acid-base catalysis
  - (D) a quaternary structure
21. D-glucose is a (an) I. aldose, II. ketose, III. pentose, IV. hexose, V. triose
- (A) I and III
  - (B) I and IV
  - (C) II and III
  - (D) II and IV
  - (E) I and V
22. Which of the followings are not monosaccharides? I. maltose, II. fructose, III. sucrose, IV. chitin, V. lignin
- (A) I, II, and III
  - (B) II, III, and IV
  - (D) I, III, and IV
  - (E) II, III, IV, and V
  - (F) I, III, IV and IV
23. Which enzyme of glycolysis catalyses an oxidation reaction of the substrate?
- (A) hexokinase
  - (B) aldolase
  - (C) triose phosphate isomerase
  - (D) glyceraldehyde-3-phosphate dehydrogenase
  - (E) enolase

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24. Which of the following hydrolytic reactions is the most exergonic?
- (A)  $\text{ATP} \rightarrow \text{AMP} + \text{PPi}$
  - (B)  $\text{ATP} \rightarrow \text{ADP} + \text{Pi}$
  - (C)  $\text{glucose-6-phosphate} \rightarrow \text{glucose} + \text{Pi}$
  - (D)  $\text{PPi} \rightarrow 2 \text{Pi}$
  - (E)  $\text{phosphoenol pyruvate} \rightarrow \text{pyruvate} + \text{Pi}$
25. In gluconeogenesis, the intermediate oxaloacetate is produced by joining a pyruvate molecule with
- (A) the acetyl group from an acetyl-CoA molecule
  - (B) a carbon dioxide molecule
  - (C) another pyruvate molecule
  - (D) a water molecule
  - (E) a lactate molecule
26. Which of the following enzymes is not shared by the pathways of glycolysis and gluconeogenesis?
- (A) glucose phosphate isomerase
  - (B) aldolase
  - (C) triose isomerase
  - (D) glyceraldehyde-3-phosphate dehydrogenase
  - (E) pyruvate kinase
27. Which of the following compounds contain sulfur? I. acetyl-CoA, II. thiamine, III. succinate, IV. glutathione, V. cysteine
- (A) II, IV, and V
  - (B) I, III, and IV
  - (C) I, II, IV, and V
  - (D) I, III, IV, and V
  - (E) I, II, III, IV, and V
28. Which of the following enzymes catalyze  $\text{CO}_2$ -releasing reactions?
- I. glyceraldehyde-3-phosphate dehydrogenase, II. lactate dehydrogenase,  
III. pyruvate dehydrogenase, IV. isocitrate dehydrogenase, V.  $\alpha$ -ketoglutarate dehydrogenase
- (A) I and IV
  - (B) I, II, and IV
  - (C) I, IV, and V
  - (D) III, IV, and V
  - (E) I, III, IV, and V
29. Which of the following components of the mitochondrial electron transport chain carry both electrons and protons in their reduced forms? I. flavin mononucleotide, II. ubiquinone, III. iron-sulfur proteins, IV. cytochrome *c*, V cytochrome *c* oxidase
- (A) I, and II
  - (B) II, and III
  - (C) I, and III
  - (D) II, and IV
  - (E) IV, and V

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30. What yield of ATP can be expected from complete oxidation of one molecule of glyceraldehyde-3-phosphate by the reactions of glycolysis, the tricarboxylic acid cycle, and oxidative phosphorylation?  
(A) 34 (B) 32 (C) 17 (D) 13.5 (E) 2.5
31. How many cycles of  $\beta$ -oxidation are required for the complete degradation of palmitic acid (a 16-carbon fatty acid)?  
(A) 4 (B) 6 (C) 7 (D) 8 (E) 9
32. Which of the followings is the correct arrangement of the redox-active components of mitochondrial electron transport chain in order of increasing standard reduction potential?  
(A)  $\text{NAD}^+$ , FAD, coenzyme Q, cytochrome *c*, cytochrome *a*  
(B) cytochrome *a*, cytochrome *c*, FAD, coenzyme Q,  $\text{NAD}^+$   
(C)  $\text{NAD}^+$ , coenzyme Q, FAD, cytochrome *c*, cytochrome *a*  
(D) cytochrome *a*, cytochrome *c*, coenzyme Q, FAD,  $\text{NAD}^+$   
(E) cytochrome *c*, cytochrome *a*, coenzyme Q, FAD,  $\text{NAD}^+$ .
33. Which of the following enzymes uses NADPH rather than NADH as a cofactor?  
(A) glyceraldehyde-3-phosphate dehydrogenase of glycolysis  
(B) pyruvate dehydrogenase  
(C) isocitrate dehydrogenase of the TCA cycle  
(D) lactate dehydrogenase in lactate fermentation  
(E) glyceraldehyde-3-phosphate dehydrogenase of the Calvin cycle
34. The enzyme glutamate dehydrogenase catalyses the assimilation reaction of  $\text{NH}_4^+$ . Which of the followings is a substrate or cofactor of this enzyme?  
(A) ATP (B) NADH (C) NADPH (D) pyridoxal phosphate (E) lipoic acid
35. The enzyme that catalyzes the conversion of the glucose-6-phosphate to fructose-6-phosphate is called a (an)  
(A) dehydrogenase (B) aminotransferase (C) lyase (D) isomerase (E) kinase
36. In alcohol fermentation, glucose is converted to ethanol and  $\text{CO}_2$  by yeast cells using which of the following pairs of enzymes?  
(A) pyruvate dehydrogenase and alcohol dehydrogenase  
(B) pyruvate decarboxylase and alcohol dehydrogenase  
(C) pyruvate-formate lyase and alcohol dehydrogenase  
(D) pyruvate carboxylase and alcohol dehydrogenase  
(E) acetaldehyde dehydrogenase and alcohol dehydrogenase

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37. Which of the following vitamins is needed by mammalian cells for the synthesis of coenzyme A?  
(A) thiamine (B) folic acid (C) niacin (D) riboflavin (E) pantothenic acid
38. Which of the following keto acids can be converted to the amino acid alanine in a single amino-transferring reaction?  
(A)  $\alpha$ -ketobutyrate (B)  $\alpha$ -ketoglutarate (C)  $\alpha$ -ketovalerate  
(D) pyruvate (E) phenylpyruvate
39. For aerobic organisms, oxygen is always the terminal electron acceptor for their electron transport chain. Which of the following compounds can be used by anaerobic bacteria as a terminal electron acceptor?  
(A)  $\text{CH}_4$  (B)  $\text{NO}_3^-$  (C)  $\text{N}_2$  (D)  $\text{H}_2$  (E)  $\text{NH}_4^+$
40. Which of the following enzymes is structurally most similar to the TCA cycle enzyme  $\alpha$ -ketoglutarate dehydrogenase?  
(A) isocitrate dehydrogenase (B) lactate dehydrogenase (C) succinate dehydrogenase  
(D) malate dehydrogenase (E) pyruvate dehydrogenase

## Section 2 : Short Answers (5 points for each question)

41. How can you get a pure protein from cell?
42. How can you define the active site of the protein?
43. What is the difference between a synthase and a synthetase?
44. What features of chloroplasts and mitochondria are consistent with the theory that they are descendents of endosymbiotic bacteria?