

國立高雄大學 102 學年度研究所碩士班招生考試試題

科目：生物化學  
考試時間：100 分鐘

系所：生命科學系  
本科原始成績：100 分

是否使用計算機：是

I. 單選題 (共 60 分；每題 2 分) 【務必將答案依序填寫於答案卷上印製的選擇題答案欄內！】

1. The 3-D structure of macromolecules is formed and maintained primarily through noncovalent interactions. Which one of the following is **NOT** considered a noncovalent interaction?
  - (a) disulfide bonds
  - (b) ionic interactions
  - (c) van der Waals interactions
  - (d) hydrogen bonds
  - (e) hydrophobic interactions
2. The  $pK_a$  of the weak base  $NH_3$  is 9.25. When present in lysosomes, a subcellular organelle, ammonia is almost totally protonated. Which of the pH values listed below is most likely for that of the lysosome lumen?
  - (a) 1
  - (b) 5
  - (c) 8
  - (d) 10
  - (e) 14
3. Humans maintain a nearly constant level of hemoglobin by continually synthesizing and degrading it. This is an example of a(n):
  - (a) equilibrium state.
  - (b) binding energy.
  - (c) dynamic steady state.
  - (d) free-energy change.
  - (e) exergonic change.
4. Which of the following is a hydrophilic amino acid?
  - (a) Serine
  - (b) aspartate
  - (c) tryptophan
  - (d) a and b
  - (e) a and c
5. Which of the following modification marks a protein for degradation in proteasomes?
  - (a) phosphorylation
  - (b) acetylation
  - (c) glycosylation
  - (d) sulfurization
  - (e) ubiquitinylation

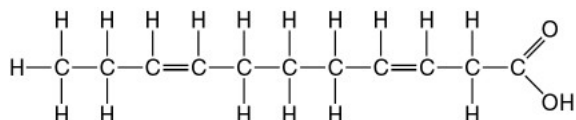
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6. Which of the following is an example of a linear motor protein?
- (a) DNA polymerase
  - (b) ribosome
  - (c) bacterial flagellum
  - (d) a and c
  - (e) a and b
7. Which of the following methods can separate proteins based on their mass?
- (a) centrifugation
  - (b) gel filtration chromatography
  - (c) SDS polyacrylamide gel electrophoresis
  - (d) all of the above
  - (e) a and c
8. How many different kinds of polypeptides, each composed of 12 amino acids, could be synthesized using the 20 common amino acids?
- (a)  $4^{12}$
  - (b)  $12^{20}$
  - (c)  $20^{12}$
  - (d) 240
  - (e) 20
9. The R group or side chain of the amino acid serine is  $-\text{CH}_2-\text{OH}$ . The R group or side chain of the amino acid leucine is  $-\text{CH}_2-\text{CH}-(\text{CH}_3)_2$ . Where would you expect to find these amino acids in a globular protein in aqueous solution?
- (a) Serine would be in the interior, and leucine would be on the exterior of the globular protein.
  - (b) Leucine would be in the interior, and serine would be on the exterior of the globular protein.
  - (c) Both serine and leucine would be on the exterior of the globular protein.
  - (d) Both serine and leucine would be in the interior of the globular protein.
  - (e) Both serine and leucine would be in the interior and on the exterior of the globular protein.
10. Which of the following statements is true regarding the molecule illustrated in following figure?



- (a) Molecules of this type are usually liquid at room temperature.
- (b) It is a saturated fatty acid.
- (c) A diet rich in this molecule may contribute to atherosclerosis.
- (d) It is a saturated fatty acid and a diet rich in this molecule may contribute to atherosclerosis.

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- (e) It is a saturated fatty acid, a diet rich in this molecule may contribute to atherosclerosis, and molecules of this type are usually liquid at room temperature.
11. When a membrane is freeze-fractured, the bilayer splits down the middle between the two layers of phospholipids. In an electron micrograph of a freeze-fractured membrane, the bumps seen on the fractured surface of the membrane are
- (a) integral proteins.
  - (b) peripheral proteins.
  - (c) phospholipids.
  - (d) carbohydrates.
  - (e) cholesterol molecules.
12. Which of the following membrane activities require energy from ATP hydrolysis?
- (a)  $\text{Na}^+$  ions moving out of a mammalian cell bathed in physiological saline
  - (b) movement of glucose molecules into a bacterial cell from a medium containing a higher concentration of glucose than inside the cell
  - (c) movement of carbon dioxide out of a paramecium
  - (d) facilitated diffusion of chloride ions across the membrane through a chloride channel
  - (e) movement of water into a cell
13. Which of the following is most likely true of a protein that cotransports glucose and sodium ions into the intestinal cells of an animal?
- (a) Sodium ions can move down their electrochemical gradient through the cotransporter whether or not glucose is present outside the cell.
  - (b) A substance that blocks sodium ions from binding to the cotransport protein will also block the transport of glucose.
  - (c) The sodium ions are moving down their electrochemical gradient while glucose is moving up.
  - (d) Glucose entering the cell along its concentration gradient provides energy for uptake of sodium ions against the electrochemical gradient.
  - (e) The cotransporter can also transport potassium ions.
14. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the  $K_m$  for that substrate. After 9 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was  $12 \mu\text{mol}$ . If, in a separate experiment, one-third as much enzyme and twice as much substrate had been combined, how long would it take for the same amount ( $12 \mu\text{mol}$ ) of product to be formed?
- (a) 1.5 min
  - (b) 3 min
  - (c) 27 min

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- (d) 3 min  
(e) 6 min
15. The double-reciprocal transformation of the Michaelis-Menten equation, also called the Lineweaver-Burk plot, is given by  $1/V_0 = K_m / (V_{max}[S]) + 1/V_{max}$ . To determine  $K_m$  from a double-reciprocal plot, you would:
- (a) take the reciprocal of the x-axis intercept.  
(b) take the reciprocal of the y-axis intercept.  
(c) take the x-axis intercept where  $V_0 = 1/2 V_{max}$ .  
(d) multiply the reciprocal of the x-axis intercept by  $-1$ .  
(e) multiply the reciprocal of the y-axis intercept by  $-1$ .
16. Which of the following is NOT a typical head group found in a glycerophospholipid?
- (a) inositol  
(b) guanine  
(c) serine  
(d) choline  
(e) hydrogen
17. Carbohydrates in membranes are typically found:
- (a) attached to glycoproteins.  
(b) as monosaccharides floating at the interface of the halves of the bilayer.  
(c) covalently bound to glycolipids.  
(d) a and c  
(e) a, b and c
18. Which of the following are true statements about the structure of ATP synthase?
- (a) It has a component called  $F_0$  embedded in the inner membrane.  
(b) It has a component found in the matrix referred to as  $F_1$ .  
(c) It has a trimer of cytochrome subunits extending into the intermembrane space.  
(d) a and b  
(e) a, b and c
19. Triacylglycerol lipase in adipocytes is stimulated by the direct or indirect action of:
- (a)  $\beta$ -oxidation.  
(b) the second messenger cAMP.  
(c) receptor binding of glucagon.  
(d) none of the above  
(e) a, b and c
20. Which statement(s) about the synthesis of urea is (are) true?

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- (a) Arginine is the precursor to urea.
  - (b) Birds directly excrete  $\text{NH}_4^+$  in their bird “droppings”.
  - (c) Only vertebrates make the enzyme arginase.
  - (d) a and c
  - (e) a, b and c
21. NADPH is generated in:
- (a) the pentose phosphate pathway.
  - (b) the citric acid cycle.
  - (c) gluconeogenesis.
  - (d) glycolysis.
  - (e) none of the above.
22. Which metabolic pathway is not considered part of carbohydrate catabolism?
- (a) the pentose phosphate pathway
  - (b) the urea cycle
  - (c) glycogenolysis
  - (d) glycolysis
  - (e) none of the above
23. Insulin action includes:
- (a) increased glycolysis.
  - (b) suppression of glycogen breakdown.
  - (c) stimulation of triacylglycerol synthesis.
  - (d) a and b
  - (e) a, b, and c
24. Which of the following amino acids can be phosphorylated?
- (a) tyr, ser, thr
  - (b) tyr, ser, trp
  - (c) ser, thr, asn
  - (d) his, ser, phe
  - (e) tyr, met, trp
25. How is calmodulin activated?
- (a) By binding both calcium and potassium
  - (b) By binding  $\text{Ca}^{2+}$  when the cytosolic concentration is greater than 500 nM
  - (c) By binding to a positively charged helix on another protein
  - (d) All of the above
  - (e) None of the above

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26. What two 3-carbon molecules are generated by the cleavage of fructose-1,6-bisphosphate?
- (a) Glyceraldehyde-3-phosphate and 3-phosphoglycerate
  - (b) Glyceraldehyde-3-phosphate and dihydroxyacetone phosphate
  - (c) Pyruvate and phosphoenolpyruvate
  - (d) Enolase and 2-phosphoglycerate
  - (e) Glyceraldehyde-3-phosphate and pyruvate
27. Which of the following conditions will activate pyruvate dehydrogenase kinase, which catalyzes the phosphorylation and inactivation of  $E_1$  in the pyruvate dehydrogenase complex?
- (a) Elevated concentrations of NADH and ATP
  - (b) Elevated concentrations of  $NAD^+$  and ADP
  - (c)  $Ca^{2+}$
  - (d) Insulin
  - (e) Elevated concentrations of acetyl-CoA
28. What is a cytochrome?
- (a) A protein that transfers electrons, and that also contains a heme prosthetic group
  - (b) A chloroplast protein that transfers electrons, and that also contains an iron sulfur prosthetic group
  - (c) A protein that pumps ATP, and that also contains iron
  - (d) All of the above
  - (e) None of the above
29. The pathway of electron flow from  $H_2O$  to  $NADP^+$  in photosynthesis is referred to as
- (a) cooperative special pairs
  - (b) photorespiration
  - (c) the Z scheme of photosynthesis
  - (d) photophosphorylation
  - (e) None of the above
30. What is the source of carbons for the Calvin cycle?
- (a) Glucose
  - (b) Glycogen
  - (c) Carbon dioxide
  - (d) Glyoxylate
  - (e) None of the above

II. 專有名詞解釋 (每題 2 分；共 20 分)

1. ABC transporter

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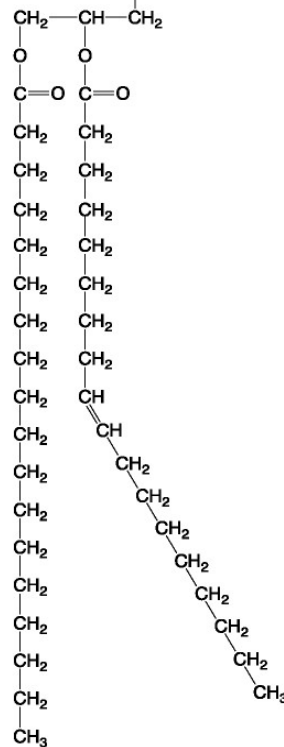
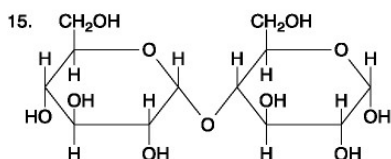
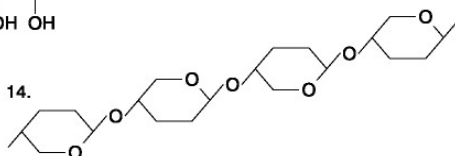
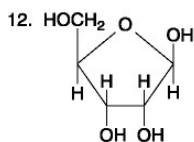
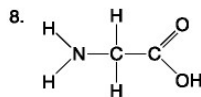
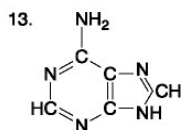
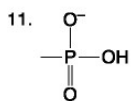
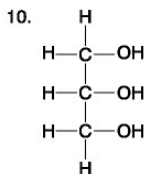
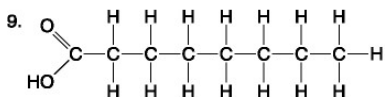
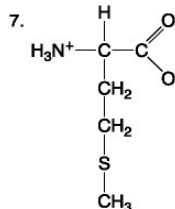
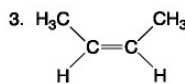
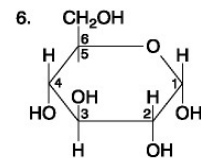
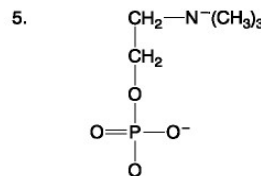
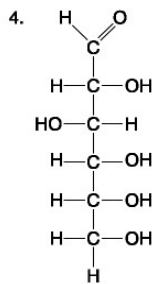
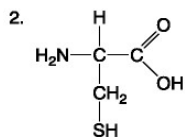
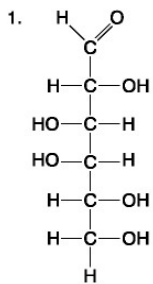
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2. isoelectric point (pI)
3. induced fit model
4. ion-exchange chromatography
5. zymogen
6. ketone body
7. LDL
8. nitrogen fixation
9. proteasome
10. Q pool

III. 問答題 (每題 10 分；共 20 分)

1. The following questions are based on the 15 molecules illustrated as below.



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- (1) Which molecule has both hydrophilic and hydrophobic properties and would be found in plasma membranes?
- (2) Which molecules combination could be linked together to form a nucleotide?
- (3) Which molecules act as building blocks (monomers) of polypeptides?
- (4) Which of the following molecules contains a glycosidic linkage type of covalent bond?
- (5) Which molecule is a saturated fatty acid? Which molecule is glycerol?

2. Please describe the mechanisms that cell protects itself from oxidative damage.

(試題結束，祝您金榜題名！)