

考生注意事項：所有考題務必在答案卷上作答，在問題卷上作答者不計分。

I. 選擇題 (1-14 題，每題一分，答錯倒扣 0.25 分，均為單選)

Questions 1-9. Please answer the question using peptides A-E

- A. C-P-R-A
- B. D-W-Y-A
- C. D-H-E-A
- D. R-K-M-N
- E. R-G-P-N

Which one of the above tetrapeptides:

1. is most negatively charged at pH 7.0?
2. is most positively charged at pH 7.0?
3. has pI around 4?
4. contains the largest number of nonpolar side chains?
5. contains amino acid with  $\text{CH}_2\text{CH}_2\text{-S-CH}_3$  side chain?
6. has the greatest light absorbance at 280 nm?
7. will form disulfide bond?
8. has the highest propensity to form a turn structure?
9. What is the net charge of peptide A (Arg-Glu-Pro-Lys) at pH 7.0?
  - A. 2
  - B. 1
  - C. 0
  - D. -1
  - E. -2
10. Which of the following is associated for determining the dihedral angle (psi) of the peptide bonds?
  - A.  $\text{C}_\text{O}-\text{N}_\text{H}-\text{C}_\alpha-\text{C}_\text{O}$
  - B.  $\text{N}_\text{H}-\text{C}_\alpha-\text{C}_\text{O}-\text{N}_\text{H}$
  - C.  $\text{C}_\alpha-\text{C}_\text{O}-\text{N}_\text{H}-\text{C}_\alpha$
  - D.  $\text{H}_\text{N}-\text{C}_\alpha-\text{C}_\text{O}-\text{N}_\text{H}$
  - E.  $\text{H}_\alpha-\text{C}_\text{O}-\text{N}_\text{H}-\text{H}_\alpha$
11. Type I turn has CO(i) to NH(i + ?) hydrogen bond pattern?
  - A. 2
  - B. 3
  - C. 4
  - D. 5
  - E. 6

(背面仍有題目,請繼續作答)

12. The E6V mutation in the  $\beta$ -subunit of Hemoglobin (Hb) results in aggregation of the protein because \_\_\_\_\_ interactions among Hb were abolished.
- A. covalent bond
  - B. hydrogen bond
  - C. van der Waals interaction
  - D. electrostatic interaction
  - E. hydrophobic interaction
13. The IgA is a dimeric antibody, how many antigens it can bind?
- A. 1
  - B. 2
  - C. 4
  - D. 8
  - E. 10
14. An antibody binds to an antigen with a  $K_d$  of 0.6 nM. At what concentration of antigen will  $\theta$ , the fraction of antigen-binding site on the antibody that are occupied by antigen, be 1/3?
- A. 0.1 nM
  - B. 0.2 nM
  - C. 0.3 nM
  - D. 0.4 nM
  - E. 0.6 nM

II. 選擇題 (15-22 題，每題二分，答錯倒扣 0.5 分，均為單選)

15. When excess acetyl -CoA, produced by the liver, cannot be utilized by the TCA cycle, it accumulates in the body as
- A. Glucose
  - B. Triglycerides
  - C. Acetyl-CoA
  - D.  $\beta$ -Hydroxybutyrate
  - E. Glycogen
16. Human fatty acid oxidation is controlled by:
- A. The activity of lipoprotein lipase in all tissues.
  - B. Malonyl-CoA inhibition of carnitine acyltransferase I in the liver
  - C. Simple substrate availability.
  - D. Allosteric regulation on two of the enzymes of the beta oxidation pathway.
  - E. Phosphorylation of acetyl-CoA carboxylase

17. Fatty acids enter the mitochondrial matrix for oxidation:
- In the form of acyl-CoAs directly by active transport.
  - As free fatty acid.
  - Following conversion to carnitine.
  - Complexed with carnitine as acyl-carnitines.
  - In the form of acyl-CoAs by passive diffusion.
18. During fasting or starvation, the brain receives energy in the form of
- Acetyl-CoA.
  - Acetoacetyl-CoA.
  - Hydroxymethylglutaryl-CoA.
  - $\gamma$ -hydroxybutyrate.
  - Glucose.
19. Triacylglycerol degradation generates free glycerol, which can be utilized for the :
- Synthesis of ATP.
  - Synthesis of glycogen.
  - Synthesis of platelet activating factor (PAF).
  - Synthesis of triacylglycerols.
  - All of the above.
20. Synthesis of fatty acids requires:
- NADH.
  - FADH.
  - NADPH
  - $\text{NAD}^+$ .
  - $\text{NADP}^+$ .
21. Regulation of fatty acid synthesis occurs:
- By phosphorylation of inactive fatty acid synthase.
  - By phosphorylation of inactive acetyl-CoA carboxylase.
  - By dephosphorylation of inactive fatty acid synthase.
  - By dephosphorylation of inactive acetyl-CoA carboxylase.
  - Fatty acid synthesis is essentially unregulated.
22. Liver cells contribute to the overall bodily content of ketone bodies primarily because they lack:
- the form of the  $\beta$ -ketothiolase necessary to hydrolyze acetoacetyl-CoA.
  - the enzyme hydroxymethylglutaryl-CoA-lyase.
  - the enzyme hydroxymethylglutaryl-CoA-synthetase.
  - the enzyme acetoacetate succinyl-CoA transferase.
  - the enzyme  $\beta$ -hydroxybutyrate dehydrogenase.

III. 選擇題 (23-32 題, 每題二分, 答錯倒扣 0.5 分, 均為單選)

Answer the following questions using the key outlined below:

- A. if 1, 2, and 3 are correct
  - B. if 1 and 3 are correct
  - C. if 2 and 4 are correct
  - D. if only 4 is correct
  - E. if all four are correct
23. Proteoglycans
- 1. are macromolecules of the extracellular matrix.
  - 2. contain glycosaminoglycan which is a family of linear polymers composed of repeating disaccharide units.
  - 3. contain a very high density of negative charges.
  - 4. only contain D-form hexose derivatives.
24. The steps of glycolysis between glyceraldehy-3-phosphate and phosphoenolpyruvate involve which of the following?
- 1. the formation of 1,3-bisphosphoglycerate.
  - 2. oxidation of NADH to NAD<sup>+</sup>.
  - 3. ATP synthesis.
  - 4. utilization of ATP.
25. Which of the following enzymes catalyzes the formation of ATP during glycolysis?
- 1. Enolase
  - 2. Phosphoglycerate kinase
  - 3. Hexokinase
  - 4. Pyruvate kinase
26. Which of the following enzymes catalyzes the TPP-dependent reactions?
- 1. Pyruvate decarboxylase
  - 2. Transaldolase
  - 3. Transketolase
  - 4. Phosphorylase
27. Oxidation of one mole of acetyl-CoA via the citric acid cycle results in net
- 1. production of 8 moles of ATP.
  - 2. production of one mole of citrate
  - 3. consumption of one mole of oxaloacetate.
  - 4. production of 2 moles of CO<sub>2</sub>.

28. The citric acid cycle is inhibited by
1. high ratio of  $[NADH]/[NAD^+]$ .
  2. high ratio of  $[ATP]/[ADP]$ .
  3. high concentration of succinyl-CoA.
  4. high concentration of oxaloacetate.
29. If oligomycin is added to tightly coupled mitochondria that are actively oxidizing succinate:
1. both electron flow and ATP synthesis will cease
  2. electron flow will continue, but ATP synthesis will cease.
  3. subsequent addition of 2,4-dinitrophenol will restore electron transport.
  4. subsequent addition of 2,4-dinitrophenol will restore ATP synthesis.
30. Glucagon is released in response to low blood glucose levels. What is the effect of glucagon on the following enzymes?
1. It inhibits phosphofructokinase via increasing the concentration of intracellular fructose-2,6-bisphosphate.
  2. It activates fructose-1,6-bisphosphatase via decreasing the concentration of cAMP.
  3. It inhibits the phosphorylation of glycogen phosphorylase.
  4. It stimulates gluconeogenesis via cAMP-dependent protein kinase.
31. The synthesis of glycogen
1. uses UDP-glucose as substrate.
  2. uses glucose-6-phosphate as the immediate substrate for the enzyme glycogen synthase.
  3. involves addition of a glucose residue at the nonreducing end of the growing polymer.
  4. does not require the participation of a primer.
32. Glycogenin
1. is the gene that encodes glycogen synthase.
  2. is the primer on which new glycogen chains are initiated.
  3. is the enzyme that regulates the synthesis of glycogen.
  4. is the enzyme that catalyzes the synthesis of new glycogen chains.

IV. 問答題與簡答題

33. 描述人體中 glycogen phosphorylase 的調控機制(6%)
34. 描述 allosteric enzyme 的特質(5%)
35. 描述 chymotrypsin 催化反應之功能基及其作用機制(5%)

36. Please describe the relationship between albinism and Parkinson's disease, and the causes of the two diseases (10%).
37. The end products of purine catabolism are different in different organisms. Please describe catabolic pathways of purine and pyrimidine in detail (8%), and its relationship to evolution(6%).
38. Concerning the conformation of double helix DNA, how many forms have been proposed. Please make the comparison among those forms of DNA(10%).