

注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 110 學年度碩士班考試入學試題


系所班組別：生命科學院

甲組(生物與醫學科學組)

科目代碼：0401

考試科目：生物化學

—作答注意事項—

1. 請核對答案卷(卡)上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清(含未依範例畫記)致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

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共 8 頁，第 1 頁 *請在【答案卡】作答

Part 1 單選題（每題二分，共六十分，答錯不倒扣。請在【答案卡】作答）

1. Secondary and higher orders of structure are determined by all EXCEPT:
(A) hydrophobic interactions,
(B) ionic bonds,
(C) peptide bonds,
(D) hydrogen bonds,
(E) van der Waals forces.
2. Tertiary structure is defined as:
(A) the folding of a single polypeptide chain in three-dimensional space,
(B) the sequence of amino acids,
(C) hydrogen bonding interactions between adjacent amino acid residues into helical or pleated segments,
(D) the way in which separate folded monomeric protein subunits associate to form oligomeric proteins,
(E) all are true.
3. A protein contains two short polypeptide chains linked by three interstrand disulfide bonds. The most logical order to perform sequencing of this protein would be:
a: The peptides are reduced with mercaptoethanol.
b: The peptides are sequenced using Edman chemistry.
c: The peptides are separated by chromatography techniques.
d: The peptides are alkylated with iodoacetamide.
(A) c, a, d, b,
(B) c, d, b, c,
(C) a, b, c, d,
(D) a, c, d, b,
(E) a, d, c, b.
4. _____ is specific in hydrolyzing peptide bonds where the carboxyl function is contributed by a lysine or an arginine residue.
(A) CNBr,
(B) carboxypeptidase,
(C) trypsin,
(D) chymotrypsin,
(E) none of the above.

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共 8 頁，第 2 頁 *請在【答案卡】作答

5. A protein's particular conformation is described below EXCEPT:
(A) the overall three-dimensional structure of the protein,
(B) achieved by breaking and reforming hydrogen bonds,
(C) achieved by rotations about each single bond along the peptide backbone,
(D) the result of amino acid side-chain interactions,
(E) none, all are true.
6. NADPH generally can be obtained from
(A) glycolysis,
(B) TCA cycle,
(C) pentose phosphate pathway,
(D) fatty acid oxidation,
(E) gluconeogenesis.
7. Cytochrome c oxidase is NOT able to inhibit by
(A) cyanide,
(B) quercetin,
(C) sodium azide,
(D) carbon monoxide,
(E) sulfide.
8. The active site of oxygen-evolving complex of photosystem II contains a metal cluster that consists of _____ manganese ions.
(A) 1,
(B) 2,
(C) 4,
(D) 5,
(E) 6.
9. Chromatin is about _____ DNA/_____ protein by weight
(A) 70%, 30%,
(B) 60%, 40%,
(C) 50%, 50%,
(D) ~~60%, 40%~~, 40% , 60%
(E) ~~70%, 30%~~, 30% , 70%

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共 8 頁，第 3 頁 *請在【答案卡】作答

10. What would be the 7-residue primer used to amplify: 5'-ATTACATAGCATAAGGCAT-3'

- (A) 5'-TAGCTGC-3'
- (B) 5'-AAGCCTT-3'
- (C) 5'-UAGCUGC-3'
- (D) 5'-ATGCCUU-3'
- (E) 5'-TGCGATG-3'

11. Formation of the ES complex results in

- (A) entropy gain,
- (B) enthalpy gain,
- (C) enthalpy loss,
- (D) entropy loss,
- (E) none of the above.

12. Ribose is mainly produced by _____ in cells.

- (A) glycolysis pathway,
- (B) pentose phosphate pathway,
- (C) citric acid pathway,
- (D) oxidative phosphorylation,
- (E) none of the above.

13. To synthesis one molecule of palmitate from acetyl-CoA and malonyl-CoA, how many electrons are involved in this anabolic process?

- (A) $2 \times 6 = 12$,
- (B) $2 \times 7 = 14$,
- (C) $4 \times 7 = 28$,
- (D) $4 \times 6 = 24$,
- (E) none of the above.

14. Based on the molecular structures of various membrane phospholipids. Which statement regarding charge character is correct?

- (A) PC, PE positive, PS, PI neutral in charge,
- (B) PC positive, PE negative, PS, PI neutral in charge,
- (C) PC, PE negative, PS, PI neutral in charge,
- (D) PC, PE neutral, PS, PI negative in charge,
- (E) none of the above.

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15. What is the overall net charge of the peptide sequence Arg-Gly-Ser-Lys-Glu-Asp at pH 7.0?

- (A) +2,
- (B) +1,
- (C) 0,
- (D) -2,
- (E) -1.

16. A Ramachandran plot shows:

- (A) the amino acid residues which have the greatest degree of rotational freedom,
- (B) the sterically allowed rotational angles between R groups and alpha-carbons in a peptide,
- (C) the sterically allowed rotational angles about the amide nitrogen (NH) and CO,
- (D) the amino acid residues that form alpha-helix, beta-sheet,
- (E) none of the above.

17. Which amino acid acts as a helix breaker due to its unique structure?

- (A) glycine,
- (B) tyrosine,
- (C) arginine,
- (D) serine,
- (E) proline.

18. All of the following play as a feedback inhibitor of glutamine synthetase EXCEPT?

- (A) AMP,
- (B) glucosamine-6-phosphate,
- (C) proline,
- (D) histidine,
- (E) CTP.

19. All of the following are characteristics of phenylketonuria EXCEPT?

- (A) untreated patients suffer severe mental retardation,
- (B) air oxidation causes urine to turn dark on standing,
- (C) treated by putting patient on a diet low in phenylalanine,
- (D) excretion of phenylpyruvate,
- (E) deficiency or defect in phenylalanine hydroxylase.

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20. All are characteristics of xanthine oxidase EXCEPT?
(A) present in large amounts in liver, intestinal mucosa and milk,
(B) uses molecular oxygen and produces H_2O_2 ,
(C) involved in direct production of urea,
(D) possesses an electron-transport chain with FAD, Fe-S cluster and molybdenum cofactor
(E) all are true.
21. Which of the following is the mechanism of action of 5-fluorouracil?
(A) competitive inhibitor of dihydrofolate reductase,
(B) non-competitive inhibitor of thioredoxin reductase,
(C) competitive inhibitor of ribonucleotide reductase,
(D) suicide substrate for thymidylate synthase,
(E) none of the above.
22. Which of the following equipment is not essential for current proteomics study?
(A) surface plasma resonance,
(B) isoelectric focusing electrophoresis,
(C) liquid chromatograph,
(D) SDS-PAGE,
(E) mass spectrometry.
23. Which one is the most sensitive strategy to detect proteins in gel?
(A) coomassie blue stain,
(B) silver stain,
(C) fluorescent stain,
(D) colloidal coomassie blue stain,
(E) almost the same in sensitivity.
24. In the electron transport system of mitochondria, the hydrophobic mobile carrier of electron is:
(A) cytochrome a,
(B) cytochrome c,
(C) FAD,
(D) ubiquinone,
(E) cytochrome b.

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25. Succinyl-CoA within TCA cycle provides most of the carbon atoms in the biosynthesis of _.

- (A) porphyrins,
- (B) fatty acids,
- (C) steroids,
- (D) cysteine,
- (E) lysine.

26. Insulin carries a cellular responsibility to reduce blood glucose as well as_____.

- (A) stimulates gluconeogenesis,
- (B) inhibits glycolysis,
- (C) stimulates glycogen synthesis in muscle and liver,
- (D) stimulates glycogen breakdown in liver,
- (E) inhibits phosphoprotein phosphatase-1.

27. Ethanol metabolism in liver is characterized by all of the following EXCEPT:

- (A) decreased pH levels due to lactic acidosis,
- (B) decreased NADH/NAD⁺ ratio in the cell,
- (C) decreased gluconeogenesis activity resulting in hypoglycemia,
- (D) two oxidation steps to convert ethanol to acetate, both reactions produce NADH,
- (E) increased acetaldehyde-protein adducts impairing protein function.

28. Fatty acids are released from adipocytes when:

- (A) insulin levels are high,
- (B) glycerol-3-phosphate levels are high,
- (C) blood glucose levels are low adipose ATP levels are high,
- (D) adipose ATP levels are high,
- (E) none are true.

29. All of the following are fuels for contracting muscles during anaerobic metabolism EXCEPT:

- (A) ATP,
- (B) palmitic acid,
- (C) glycogen,
- (D) glucose,
- (E) creatine phosphate.

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30. Herbicides (e.g., "Roundup") inhibit biosynthesis of "essential" amino acids because animals do not have enzymes of:
- (A) photosynthesis,
 - (B) glyoxylate cycle,
 - (C) glutamine synthesis pathway,
 - (D) Phe, Val, Leu, Ile and His biosynthetic pathways,
 - (E) none of above.

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Part 2 問答題（每題十分，共四十分。請在【答案卷】務必依序作答）

1. Please explain the process of how human body synthesizes Oleic acid, C18:1, Δ^9 . Please include the steps of lipid elongation process, Acetyl-CoA, malonyl-CoA, NADPH and Δ^9 desaturase in your explanation.
2. Please explain under which condition, lactate would be formed in muscle and how the lactate in muscle can be recycled to glucose in the liver. Please explain your answer based on [NADP] and [NAD⁺] in muscles and liver.
3. Monosaccharides can have many stereoisomers. (A) How many stereoisomers are possible for the ketopentose? (B) How many L-stereoisomers can the aldopentose have?
4. Positive-inside rule is used to facilitate the determination of membrane protein's orientation. (A) Please explain what the positive-inside rule is? (B) What feature of the plasma membrane leads to this rule?