

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 112 學年度碩士班考試入學試題

系所班組別：生命科學暨醫學院
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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考試科目（代碼）：生物化學(0401、0501、0701)

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*請在【答案卡】作答

Part 1 選擇題，20 題單選題（每題 1 分，共 20 分），答錯不倒扣

1. To synthesize one molecule of palmitate from acetyl-CoA and malonyl-CoA, how many electrons are involved? (A) 12, (B) 16, (C) 28, (D) 18, (E) 32.
2. The driving force(s) for fatty acid biosynthesis from acetyl-CoA (A) ATP, carboxylation, decarboxylation, (B) ATP, carboxylation, decarboxylation, NADH, (C) ATP, NADPH, decarboxylation, (D) ATP, NADH, carboxylation, (E) ATP, carboxylation, decarboxylation, NADPH.
3. Regarding transaldolase and transketolase, (A) both transfer 1-carbon unit, (B) both transfer 2-carbon unit, (C) both transfer 4-carbon unit, (D) transaldolase transfers 2-carbon and transketolase transfers 3-carbon, (E) transaldolase transfers 3-carbon and transketolase transfers 2-carbon.
4. Glycolysis is enhanced by (A) fructose-1,6-bisphosphate, (B) glucose-1-phosphate, (C) fructose-2,6-bisphosphate, (D) glucose-6-phosphate and fructose-1,6-bisphosphate, (E) fructose-1,6-bisphosphate and fructose-2,6-bisphosphate.
5. Edman degradation will: (A) determine the C-terminal amino acid by using a carboxypeptidase, (B) cleave the protein into a multitude of smaller peptides, (C) compare overlapping sets of peptide fragments, (D) determine the N-terminal amino acid, (E) generate two different, but overlapping sets of peptide fragments.
6. What is the overall net charge on the peptide "LKGDGARE" at pH 7.0? (A) +2, (B) +1, (C) 0, (D) -2, (E) -1.
7. The large negative free energy change of ATP on hydrolysis is due to: (A) destabilization due to electrostatic repulsion, (B) stabilization of products by ionization and resonance, (C) entropy factors arising from hydrolysis and ionization, (D) free energy change $\sim 35\text{kJ/mol}$, (E) all of the above.

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*請在【答案卡】作答

8. Which amino acid acts as a helix breaker due to its unique structure? (A) Histidine, (B) Tyrosine, (C) Arginine, (D) Serine, (E) Proline.
9. Which enzyme is not involved the carbon fixation of the Calvin cycle in C₄ plants? (A) Fructose-1,6-bisphosphatase, (B) NADP-dependent malic enzyme, (C) Pyruvate phosphate dikinase (PPDK), (D) NADP-malate dehydrogenase, (E) Phosphoenolpyruvate carboxylase (PEPC).
10. Which descriptions about the non-cyclic photophosphorylation is not correct? (A) PSI and PSII are involved, (B) electron travels back to PSI, (C) electron from PSII is accepted by NADP⁺, (D) ATP is produced, (E) water splitting is involved.
11. After glycolysis, the generated pyruvate must be oxidized into which molecule before entering the TCA cycle? (A) succinyl-CoA, (B) nicotine adenine dinucleotide, (C) coenzyme A, (D) acetyl-CoA, (E) ATP.
12. Which process releases dinitrogen gas (N₂) back into the atmosphere? (A) Denitrification, (B) nitrogen fixation, (C) decay, (D) nitrification, (E) nitrogen assimilation.
13. If an error is made during replication that is not caught by DNA polymerase, the most likely is that _____.
(A) both strands of DNA will be mutated
(B) only the daughter strand will be mutated
(C) a mutation that causes cancer will occur
(D) DNA ligase will repair the mistake before a mutation occurs
(E) DNA replication will stall indefinitely

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共 5 頁，第 3 頁

*請在【答案卡】作答

14. Homeotic genes encode which type of protein?
- (A) transcription factors
 - (B) ribosomal proteins
 - (C) channel proteins
 - (D) membrane-associated proteins
 - (E) DNA methylases
15. As the polypeptide is elongating during translation, what is the ribosome doing?
- (A) removing incorrectly added amino acids
 - (B) moving along the mRNA transcript bonding amino acids to each other
 - (C) travelling back and forth between the nucleus and the growing polypeptide with information on which amino acids to add
 - (D) removing the noncoding introns
 - (E) breaking hydrogen bonds between the tRNA and the mRNA
16. How do steroid hormones differ from those derived from amino acids?
- (A) Steroid hormones are not derived from organic molecules.
 - (B) Steroid hormones do not bind to plasma membrane receptors.
 - (C) Steroid hormones use a second messenger system.
 - (D) Steroid hormones do not travel in the blood.
 - (E) Steroid hormones do not require receptors to function.
17. Cholesterol is the precursor for the following lipids, **EXCEPT** _____. (A) cortisol, (B) estradiol, (C) cholic acid, (D) progesterone, (E) cardiolipin.
18. Which lipid **is not** the major component of biological membranes? (A) lysophospholipid, (B) phosphatidylcholine, (C) phosphatidylethanolamine, (D) sphingolipid, (E) cholesterol.

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共 5 頁，第 4 頁

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19. Myristoylation is a lipid modification of protein. Where is the amide-linked myristoyl anchor attached to? (A) N-terminal Lys (B) N-terminal Gly, (C) C-terminal Asp, (D) C-terminal Cys, (E) Ser.
20. Which one **is not** a diastereomer of D-glucose? (A) D-galactose, (B) D-mannose, (C) L-galactose, (D) D-ribose, (E) L-Idose.

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*請在【答案卷】作答

Part 2 簡答題 10 題 (每題 8 分，共 80 分)

1. What is the start building block of cholesterol (2 points) ? What is the control enzyme for cholesterol biosynthesis (2 points) ? What is the major transporter of cholesterol in circulation system (2 points) ? How cells manipulate the oversupply of cholesterol (2 points) ?
2. What is the salvage pathway of purine (2 points) ? What reactions (substrates & products) are involved (2 points) ? What is the key enzyme in response to this process (1 point) ? What disease is caused by the deficiency of this key enzyme? (2 points) What is the outcome of the disease (1 point) ?
3. Draw the peptide formation reaction and list FOUR characteristics of peptide bond. (8 points)
4. What are the four levels of organization for protein structure? Please explain (8 points)
5. What are the primary and secondary pigments of photosynthesis (2 points)? How do they each work in the process of photosynthesis (6 points)?
6. What is non-alcoholic fatty liver disease (NAFLD) (2 points)? What is the difference between glucose and fructose intake in terms of insulin signaling (2 points)? Please explain some possible mechanism involved in the promotion of NAFLD due to fructose overconsumption from the perspective of metabolism (4 points).
7. Please lists two kinds of DNA repair mechanisms and describe it in detail (8 points).
8. Please describe in detail about epigenetic processes (8 points).
9. (1) Which transport process across the biological membrane requires protein but not energy? (2) What is the driving force for this process? (8 points).
10. (1) Does disulfide bond formation mostly occur in the cytoplasmic or extracellular domain of transmembrane proteins under normal physiological conditions? (2) Please explain why (8 points).