

國立清華大學 107 學年度碩士班考試入學試題

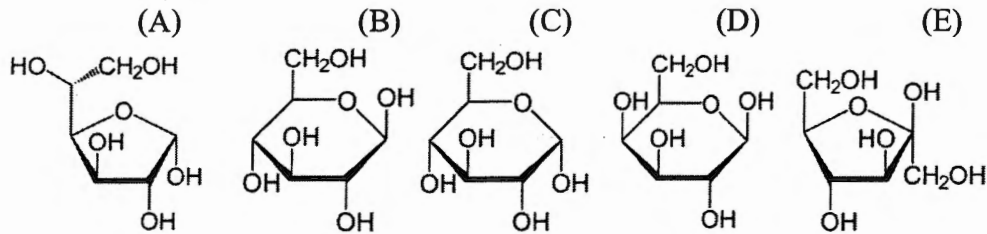
系所班組別：生命科學院甲組、乙組、丁組

考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 1 頁 *請在【答案卡】作答

Part 1 單選題 (每題二分，共三十分，答錯不倒扣。請在【答案卡】作答)

1. Which of the following monosaccharide is the most stable in nature?



2. Which of the following statements about membrane lipids is FALSE?

- (A) Plasma membranes are enriched in phosphatidylcholine and phosphatidylethanolamine.
- (B) Lipid compositions are not evenly distributed in different organelles.
- (C) The membrane fluidity is enhanced by the increase of saturation in phospholipids.
- (D) The inner leaflet and the outer leaflet of plasma membranes have different lipid compositions.
- (E) Most membrane lipids are amphipathic.

3. Which of the following method can be used to predict membrane protein topology?

- (A) Hydropathy plot
- (B) Determination of melting point
- (C) Ramachandran plot
- (D) Two-dimensional gel electrophoresis
- (E) None of the above

國立清華大學 107 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、丁組

考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 2 頁 *請在【答案卡】作答

4. What is/are the difference(s) between passive diffusion and facilitated diffusion?
- (A) Passive diffusion does not require protein transporters, while facilitated diffusion does.
 - (B) Passive diffusion does not require ATP hydrolysis, while facilitated diffusion does.
 - (C) Passive diffusion does not display saturation behavior, while facilitated diffusion does.
 - (D) All of the above
 - (E) A and C
5. Which of the following monosaccharides are anomers of each other?
- (A) Alpha-D-Glucose and Beta-L-Glucose
 - (B) D-Sorbose and D-Fructose
 - (C) D-Fructose and D-Glucose
 - (D) Alpha-D-fructose and Beta-D-fructose
 - (E) L-Glucose and L-Galactose
6. The process of electron transport will generate ATP. In the last stage, where does the energy that drives ATP synthesis come from?
- (A) The proton gradient
 - (B) NAD^+ and FAD
 - (C) The electron gradient
 - (D) The oxidation states of the complexes
 - (E) Molecular oxygen
7. All of the following are in the mitochondria EXCEPT:
- (A) enzymes for fatty acid oxidation
 - (B) adenylate kinase
 - (C) TCA cycle
 - (D) the electron transport complexes
 - (E) pentose phosphate pathway

國立清華大學 107 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、丁組

考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 3 頁 *請在【答案卡】作答

8. The reaction of photosynthesis whereby light energy is transduced into chemical energy uses _____ as a source of carbon, and produces _____.
- (A) CO₂; hexose
 - (B) hexose; CO₂
 - (C) acetyl CoA; hexose
 - (D) CO₂; acetyl CoA
 - (E) none of the above.
9. Carotenoids have primary roles in photosynthesis as:
- (A) accessory light-harvesting and photooxidation
 - (B) accessory light-harvesting and photoprotection from reactive oxygen species
 - (C) resonance transfer pigments and photooxidation
 - (D) resonance transfer and photodiffusion protection
 - (E) none are true.
10. If levels of _____ and/or _____ are low, pyruvate is directed primarily into _____; but if they are high, pyruvate is converted into _____ for gluconeogenesis.
- (A) NADH; ATP; glycolysis; OAA
 - (B) ATP; NADPH; glycolysis; acetyl CoA
 - (C) ATP; acetyl CoA; TCA cycle; OAA
 - (D) NAD⁺; acetyl CoA; TCA cycle; acetyl CoA
 - (E) ATP; acetyl CoA; glycolysis; malate
11. All of the following are characteristics of phenylketonuria EXCEPT:
- (A) excretion of phenylpyruvate
 - (B) air oxidation causes urine to turn dark on standing
 - (C) treated by putting patient on a diet low in phenylalanine
 - (D) untreated patients suffer severe mental retardation
 - (E) deficiency or defect in phenylalanine hydroxylase.

國立清華大學 107 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、丁組

考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 4 頁 *請在【答案卡】作答

12. Many _____ and _____ are inhibitors of purine and pyrimidine biosynthesis.

- (A) eicosanoids; aspirin
- (B) NSAIDs; antibiotics
- (C) antibiotics; eicosanoids
- (D) anticancer drugs; antibiotics
- (E) none of the above.

13. Adenylosuccinase (adenylosuccinate lyase) catalyzes the reaction to remove _____ after _____ has formed an amide with a carbonyl group in purine biosynthesis.

- (A) succinate; glutamate
- (B) succinate; aspartate
- (C) fumarate; alanine
- (D) fumarate; aspartate
- (E) alpha-ketoglutarate; glutamate

14. The fate of IMP is regulated by relative levels of _____ and _____; and energy to drive AMP synthesis is provided by _____, and energy for GMP synthesis by _____.

- (A) IMP; PRPP; ATP; GTP
- (B) PRPP; ATP; ATP; GTP
- (C) AMP; ATP; GTP; ATP
- (D) AMP; GMP; GTP; ATP
- (E) none of the above.

15. The immediate reducing power of ribonucleotide reductase is provided by:

- (A) thioredoxin
- (B) Ferredoxin
- (C) NADH
- (D) Fe-S complex
- (E) Cyt P-450.

國立清華大學 107 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、丁組

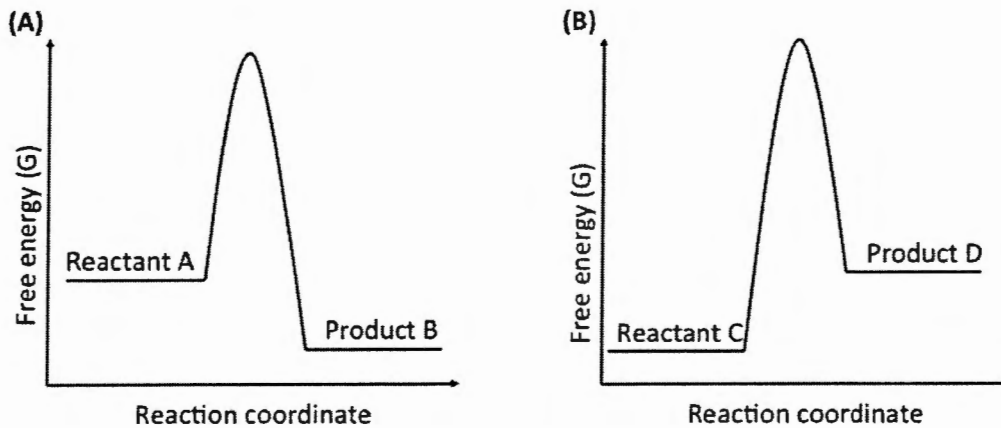
考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 5 頁 *請在【答案卷】作答

Part 2 問答題 (每題十分，共七十分。請在【答案卷】務必依序作答)

1. The reaction energy diagram (A) and (B) are shown for reaction $A \rightarrow B$ and $C \rightarrow D$.

- (1) Which reaction occurs spontaneously? (2%)
- (2) Can enzymes accelerate a slow reaction? Why or why not? (3%)
- (3) Which reaction does not occur spontaneously? (2%)
- (4) Can enzymes make a nonspontaneous reaction occur? Why or why not? (3%)



2. DNA is an important genetic material in the cell and interacts with various proteins.

- (1) What is the charge of DNA? Why? (4%)
- (2) Based on (1), what amino acids on DNA-binding proteins might contribute to the strong interactions between DNA molecules and the DNA-binding proteins? (6%)

3. Please determine the number of ATP equivalents if we complete a glucose oxidation.

Assume for the calculation that NADPH is worth 3.5 ATPs, NADH is 2.7 ATPs, and $FADH_2$ is 1.6 ATPs. (10%)

4. Please explain what is “Ketone Bodies” and the role in metabolism. Why it is important in diabetes early detection. (10%)

國立清華大學 107 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、丁組

考試科目（代碼）：生物化學(0401、0501、0701)

共 6 頁，第 6 頁 *請在【答案卷】作答

5. How can the current mass spectrometry be used for microbial identification and protein identification? (10 %)
6. Particulate matter (PM) pollution is a serious problem in environmental medicine. What are the definitions of PM₁₀, PM_{2.5} and PM_{1.0}? What are the compositions of these PMs? How PM₁₀, PM_{2.5} and PM_{1.0} affect people's health? What are the relationship between these PMs and lung cancer and cardiovascular disease? (10 %)
7. What are the roles of Acetyl-CoA in metabolism? (Please list at least 5 regulatory functions of Acetyl-CoA) (10 %)