

Part I 單選題 (1-10)，每題兩分 ※ 注意：請於試卷內之「選擇題作答區」依序作答。

- Which of the following techniques is used for protein isolation and purification?
 - Edman degradation
 - Mass spectroscopy
 - qPCR
 - Ion exchange chromatography
 - Flow cytometry
- Which of the following does NOT apply to the amino acid sequence of proteins?
 - It is read from N-terminal end to C-terminal end.
 - It is constant for proteins with the same function from different organisms.
 - It is a form of genetic information.
 - It is encoded by the nucleotide sequence of DNA.
- In a π -helix, the hydrogen bond is formed between the C=O of residue i to the -NH of _____.
 - $i+2$
 - $i+3$
 - $i+4$
 - $i+5$
 - $i+6$
- Which of the following is NOT correct for a competitive inhibitor?
 - It binds a site other than the active site.
 - For a given $[I]$, v decreases.
 - At some point, S can displace all of I on E.
 - EI does not give rise to E + P.
- Which of the following is a feature of transition-state analogs?
 - They are approximations of the transition state that bind less tightly than the substrate.
 - They are compounds that compete for the active site and are always very similar to the substrate.
 - They are not stable molecules.
 - They are stable molecules that are chemically and structurally similar to the transition state.
- Which of the following pairs of amino acids could form a charge-charge interaction through their R-groups?
 - methionine and histidine
 - glutamine and lysine
 - serine and glutamic acid
 - aspartic acid and arginine
 - threonine and asparagine
- The conversion of _____ represents a conservative change while the conversion of _____ represents a nonconservative change.
 - Asp to Arg; Ile to Ser
 - Tyr to Phe; Lys to Arg
 - Gln to Asn; Ser to Thr
 - Ile to Leu; Asn to Ala
 - Cys to His; Lys to Glu

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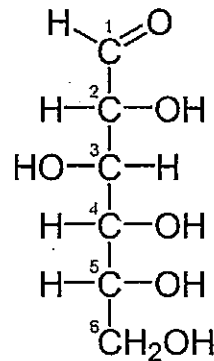
8. What type of secondary structure is most prominent in myosin?
- antiparallel β -sheet
 - parallel β -sheet
 - α -helix
 - 3_{10} helix
 - polyproline helix
9. Which of the following pairs of pathways, if active at the same time, would be considered a futile cycle?
- gluconeogenesis and citric acid cycle
 - fatty acid β -oxidation and glycolysis
 - fatty acid synthesis and glycolysis
 - fatty acid synthesis and citric acid cycle
 - glycolysis and gluconeogenesis
10. Which of the following is used to activate phosphatidic acid for conversion to various phospholipids?
- ATP
 - UTP
 - CTP
 - GTP
 - NADH

Part II 請有條理的回答下列問題 (11-13) 分數標示於各題

11. Please discuss the properties of the following amino acids. The properties should include their structural and functional roles in proteins, as well as chemical properties that make them unique. (10 %)
- Glycine
 - Tryptophan
 - Proline
 - Lysine
12. Please define and discuss the non-covalent bonds in terms of their roles in maintaining protein structure, or mediating different bio-molecular recognitions. Giving examples will help your discussion. (10 %)
13. "Saturation kinetics" is an important character when biochemists study enzyme-substrate or receptor-ligand interactions. Please explain it. And also, please describe at least two different experiments that are used in such studies? (10 %)

Part III 請簡明扼要的回答下列問題 (14-22) 分數標示於各題

14. The molecule presented below is glucose. The six carbon groups of glucose are designated from C1 to C6 as shown in the figure. Please answer the questions. (5%)



- What is the name of the molecule when C2 group is replaced by C=O?
- What is the name of the molecule when C2 group is replaced by OH—C—H?
- What is the name of the molecule when C2 group is replaced by H—C—NH₂?
- What is the name of the molecule when C1 group is replaced by CH₂OH?
- What is the name of the molecule when C6 group is replaced by COOH?

15. What is the core structure of steroids? and please give one steroid example to briefly describe its cellular function. (5%)

16. Please answer the following questions about DNA and RNA.

- What are the “chemical” differences between DNA and RNA? (2%)
- Which molecule is more susceptible for hydrolysis by dilute base? (1%)
- What is the molar ratio of Guanine to Cytosine in human DNAs? (1%)
- Which molecular can have catalytic activity? (1%)

17. Glycolysis is the metabolic pathway that converts glucose into pyruvate.

- In the glycolysis pathway, which four enzymes are involved in the reactions of ATP hydrolysis or ATP formation? (4%)
- In the glycolysis pathway, which two intermediates contain two phosphate groups? (2%)

18. Please answer the following questions about pyruvate and TCA cycle. (5%)

- Pyruvate can be converted to which molecule by pyruvate dehydrogenase complex?
- Pyruvate can be converted to which molecule by pyruvate carboxylase?
- α -ketoglutarate can be converted to which molecule by α -ketoglutarate dehydrogenase?
- Fumarate can be converted to which molecule by fumarase?
- Which coenzyme is required for the reaction of “conversion of isocitrate into α -ketoglutarate”?

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19. The TCA cycle is tightly regulated. Please describe how pyruvate dehydrogenase is regulated? (5%)

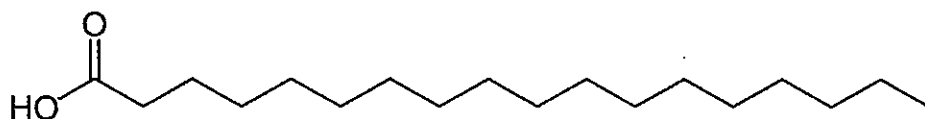
20. Photosystem I (PSI) and photosystem II (PSII) participate in the process of photosynthesis. Please answer the following questions about PSI and Calvin cycle.

- (a) Which molecule is the reducing power generated by PSI? (1%)
- (b) Which molecule is the CO₂ acceptor in the CO₂ fixation stage of Calvin cycle? (1%)
- (c) Why does the oxygenase reaction of Rubisco limit CO₂ fixation reaction? (2%)
- (d) How does C4 plant increase CO₂ uptake in CO₂ fixation. (2%)

21. Gluconeogenesis is the generation of "new glucose" from common metabolites. Pyruvate, lactate, and amino acids can be substrates for gluconeogenesis. Please answer the following questions.

- (a) Why can't fatty acid be the substrate for gluconeogenesis? (2%)
- (b) Why gluconeogenesis is not the mere reversal of glycolysis? (4%)
- (c) In gluconeogenesis pathway, which two enzymes are involved in converting pyruvate to phosphoenolpyruvate. (2%)

22. The molecule presented below is a fatty acid. Please answer the questions about fatty acid metabolism. (5%)



- (a) How many repeated cycles of the four-step oxidation process should be undertaken to complete oxidation of the present fatty acid?
- (b) In the first cycle of oxidation, which C—C bond of the present fatty acid will be broken?
- (c) Assume that each NADH is worth 2.5 ATPs and each FADH₂ is worth 1.5 ATP. How many ATPs can be generated in total after finishing the oxidation cycles?
- (d) If the final metabolites of the presented fatty acid oxidation process keep entering the TCA cycle, how many GTP can be generated in total?
- (e) The fatty acid is broken down in which cellular compartment in eukaryotes?

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