

系所組別：熱帶植物科學研究所

考試科目：生物化學

考試日期：0308，節次：2

※ 考生請注意：本試題 可 不可 使用計算機**Answer the following questions (共 14 題)**

1. What is an open reading frame (ORF)? Please write a DNA sequence containing a short ORF. (5%)
2. What are the plant genomes that have been completely sequenced? What do you know about their sequences? (5%)
3. The tiger pufferfish genome is nine times smaller than the human genome, but it contains just as many genes. How can that be? (5%)
4. List the components for *E. coli* primosome and their roles in primer synthesis. (5%)
5. Diagram the process of telomere synthesis. (5%)
6. Describe and give the results of an experiment that shows that DNA replication is semiconservative. (5%)
7. What DNA repair system is missing in the Xeroderma pigmentosum patients? (5%)
8. List the eukaryotic DNA polymerases and their roles. (5%)
9. You are studying a human disease called β -thalassemia in which no β -globin is produced. You find that the β -globin coding region in people with this disease is normal, but the mRNA is over a hundred nucleotides longer than normal. You sequence the β -globin gene in these people and find a single base change within the gene's first intron. Present a hypothesis to explain the absence of β -globin in these patients. (10%)
10. There are three major types of photosynthesis metabolism in the plants, called C3 metabolism, C4 metabolism and crassulacean acid metabolism (CAM).
 - 1) Compare the aspects of CO₂ fixation and crop yield between C3 and C4 plants?
 - 2) How is photosynthesis similar in C4 and CAM plants? (10%)
11. How are glycolysis and gluconeogenesis coordinately regulated? (7%)

(背面仍有題目,請繼續作答)

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12. Match the following functions with the correct metabolic intermediate list below.

Not all of the answers will be used. (6%)

- (A) Pyruvate
- (B) Fumarate
- (C) Glucose 1-phosphate
- (D) Glucose 6-phosphate (G6P)
- (E) Acetyl coenzyme (CoA)

- 1) It may serve as a substrate for the citric acid cycle or a precursor for cholesterol synthesis.
- 2) It couples the actions of the urea cycle and the citric acid cycle.
- 3) It may be converted to either a precursor for glycogen synthesis or a precursor for nucleotide synthesis.

13. Indicate whether each of the following statements is true or false, and explain your answer. (12%)

- 1) The citric acid cycle does not exist as such in plants and bacteria, because its functions are performed by the glyoxylate cycle.
- 2) The citric acid cycle oxidizes the acetyl CoA derived from fatty acid degradation.
- 3) Give that the nitrogen of glutamate can be redistributed by transamination, glutamate should be a good supplement for nutritionally poor protein.
- 4) Calcium ions, receptor proteins and second messengers may function in signal transduction in plants.
- 5) In signal transduction pathway, the transduction stage amplifies the original signal by involving more than one receptor molecule to receive the stimulus.
- 6) It is possible to prepare vesicles from portions of the inner membrane of the mitochondria components. Both the Krebs cycle and oxidative phosphorylation could still be carried on by this isolated inner membrane.

14. Explain the following terms and their biological significance. (15%)

- 1) anaplerotic reaction
- 2) futile cycle
- 3) carnitine
- 4) allosteric enzyme
- 5) adenylyl cyclase