

國立成功大學

113學年度碩士班招生考試試題

編 號：58

系 所：生命科學系

科 目：生物化學

日 期：0202

節 次：第 3 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Answer the following questions about isomers.

Q1. What are isomers? Briefly explain. (4 points)

Q2. Giving the simple chemical structure, explain *cis-trans* isomers. (4 points)

Q3. Thalidomide and L-dopa are examples of pharmaceutical drugs that occur as enantiomers, or molecules that _____ . (4 points)

A) have identical three-dimensional shapes

B) are mirror images of one another

C) are mirror images of one another and have the same biological activity

D) are *cis-trans* isomers

2. Answer the following questions about cell membranes

Q1. Which of the following would likely diffuse through the lipid bilayer of a plasma membrane most rapidly? : sucrose, an amino acid, O_2 , or Na^+ .(4 points)

Q2. Why do unsaturated fatty acids help keep a membrane more fluid at lower temperatures? (4 points)

Q3. Plants possess three prominent double-membrane-bounded organelles. Give all the names of the organelles. (6 points)

3. In 1953, (A) and (B) published the paper in which they described (1) the structure and of (C).

(A) also proposed the Central Dogma in 1957 (published in 1958):

“The Central Dogma. This states that once ‘information’ has passed into protein it cannot get out again. In more detail, the transfer of information from nucleic acid to nucleic acid, or from nucleic acid to protein may be possible, but the transfer from protein to protein, or from protein to nucleic acid is impossible.”

Although today we simply understand it showed that (C) is transcribed to (D), and (D) is translated into a protein, (A) already predicted the (2) special transfer from (D) to (C) in special circumstances (1970).

Q1. Fill in the banks (A~D). (3 points each)

Q2. Regarding (1), briefly describe the structure of (C). (3 points)

Q3. Regarding (2), give 1 biological example showing this process. (3 points)

Q4. Some groups of (D) are not translated to proteins and work as enzymes called ribozymes. Give 2 examples of ribozymes. (6 points)

4. A eukaryotic cell can use glucose ($C_6H_{12}O_6$) and hexanoic acid ($C_6H_{14}O_2$) as fuels for cellular respiration. On the basis of their structural formulas, which releases more energy per gram on complete combustion to CO_2 and H_2O ? (10 points)

5. In a laboratory experiment, two groups of rats are fed two different fatty acids as their sole source of carbon for a month. The first group gets heptanoic acid (7:0), and the second gets octanoic acid (8:0). After the experiment, a striking difference is seen between the two groups. Those in the first group are healthy and have gained weight, whereas those in the second are weak and have lost weight as a result of losing muscle mass. What is the biochemical basis for this difference? (10 points)
6. When young rats are placed on a totally fat-free diet, they grow poorly, develop a scaly dermatitis, lose hair, and soon die—symptoms that can be prevented if linoleate or plant material is included in the diet. What makes linoleate an essential fatty acid? Why can plant material be substituted? (10 points)
7. DNA polymerases are capable of editing and error correction, whereas the capacity for error correction in RNA polymerases seems to be quite limited. Given that a single base error in either replication or transcription can lead to an error in protein synthesis, suggest a possible biological explanation for this difference. (10 points)
8. How would the SOS response in *E. coli* be affected by a mutation in the *lexA* gene that prevented autocatalytic cleavage of the LexA protein? (10 points)