

國 立 清 華 大 學 命 題 紙

95 學年度 _____ 工學院 _____ 系 (所) _____ 生物工程學程 _____ 組碩士班入學考試

科目 _____ 生物化學 _____ 科目代碼 _____ 1302 _____ 共 _____ 3 _____ 頁第 _____ 1 _____ 頁 *請在【答案卷卡】內作答

1. 一酵素反應



之動力學數據如下：[E]₀ = 1 mg

A (μ M)	Initial rate (μ M/min)
210	14.0
110	11.3
85	9.80
64	7.84
42	6.67

請寫出此一反應的速率方程式並決定其中各參數的值 (15%)

2. 請解釋或說明下列與酵素有關之名詞 (10%)

- Cofactor
- Competitive inhibition
- Lineweaver-Burk plot (Double reciprocal plot)
- Substrate specificity

3. In biological systems, there are three main classes of biopolymers—proteins and polypeptides, polynucleotides, and polysaccharides. Please describe the basic chemical structure and the primary roles of each class of these biopolymers (15%).

4. Explain the following terminology: (10%)

- Denaturation (or shrinkage) temperature (e.g., collagen)
- Salt out (e.g., for protein separation)
- Osmotic pressure
- Micelle

國立清華大學 命題紙

95 學年度 _____ 工學院 _____ 系 (所) _____ 生物工程學程 _____ 組碩士班入學考試

科目 _____ 生物化學 _____ 科目代碼 _____ 1302 _____ 共 _____ 3 _____ 頁第 _____ 2 _____ 頁 *請在【答案卷卡】內作答

5. The following Figure 1 represents a gut cell (腸細胞). Please indicate exactly where inside a cell the following processes take place. (9%)

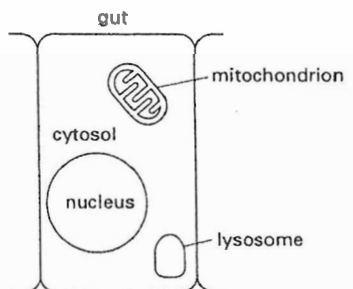
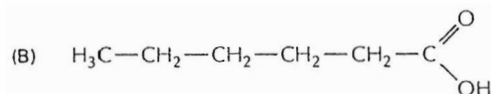
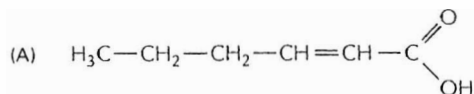


Figure 1

- (1) Glycolysis
 - (2) Citric acid cycle
 - (3) Conversion of pyruvate to activated acetyl groups
 - (4) Oxidation of fatty acids to acetyl CoA
 - (5) Release of fatty acids from triacylglycerols
 - (6) Oxidative phosphorylation
6. Please discuss “true or false (對或錯)” of the following statements and explain your answers. (10%)
- The oxidation of sugars by glycolysis
- (a) occurs only in aerobic organisms.
 - (b) generates carbon dioxide.
 - (c) produces a net gain of ATP.
 - (d) occurs in mitochondria.
 - (e) uses NADH as a source of energy.
7. Assuming complete oxidation, which of the fatty acids shown in the following figure will generate the most ATP through cellular respiration? Why? (6%)



國 立 清 華 大 學 命 題 紙

95 學年度_____工學院_____系(所)_____生物工程學程_____組碩士班入學考試

生物化學_____科目代碼_1302_共_3_頁第_3_頁 *請在【答案卷卡】內作答

8. DNA, RNA and protein

(a) Describe the central dogma of molecular biology, that is, what is the relation between DNA, RNA and protein? (4%)

(b) For the following DNA sequence (note its direction), please find the sequence of the complementary strand (4%).

5'—AAAT ATGAAA TTC TTA GTC AAC GTT GCC TAA TCC--3'

(c) For the DNA sequence in (b), please find the mRNA sequence it may encode (4%) (hint: find the start codon).

9. DNA cloning and recombinant protein expression

(a) Starting from the source gene and an empty plasmid vector, please outline the 4 major steps in creating a recombinant plasmid for recombinant protein expression? (4%)

(b) Briefly describe and explain what tools are used in these steps (5%)?

(c) To achieve high level, controllable expression of proteins that can be easily purified, what features are generally incorporated in the expression vectors? (4%)