

國立成功大學
110學年度碩士班招生考試試題

編 號： 305

系 所： 分子醫學研究所

科 目： 分子生物學

日 期： 0203

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。

Part I 單選題共 30 分

1. Which is the structure that ends bacterial transcription? (3%)
 - A. Stop codon
 - B. Shine-Dalgarno sequence
 - C. Terminator
 - D. TATA box
 - E. A sequence rich in C and poor in G

2. Which of the followings is a mutation that can cause the substitution of one amino acid with another in the gene product? (3%)
 - A. Missense mutation
 - B. Frameshift mutation
 - C. Non-sense mutation
 - D. Silent mutation
 - E. Amber mutation

3. Anticodon is located on which of the following structures? (3%)
 - A. DNA
 - B. Ribosome
 - C. mRNA
 - D. tRNA
 - E. DNA polymerase

4. Which of the subunits of prokaryotic RNA polymerase is responsible for promoter recognition? (3%)
 - A. The α subunit
 - B. The β subunit
 - C. The β' subunit
 - D. The σ subunit
 - E. The β and β' subunits

5. 5'-CAGTACGTA-3' is the coding strand sequence of a gene fragment. This gene fragment will be transcribed as: (3%)
 - A. 5'-ATGCATGAC-3'
 - B. 5'- CAGTACGTA -3'

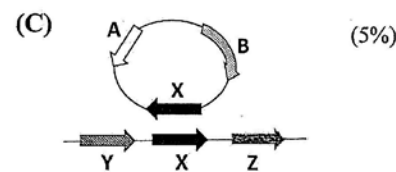
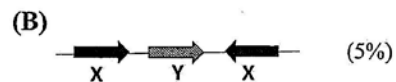
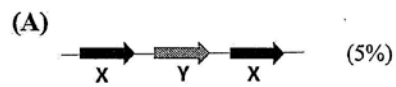
- C. 5'-TACGTACTG-3'
D. 5'-UACGUACUG-3'
E. 5'- CAGUACGUA -3'
6. Which allows the interaction between codon and anti-codons during DNA translation? (3%)
A. RNA polymerase
B. ATP
C. DNA ligase
D. Restriction enzyme
E. Complementary base pairing
7. Which is the function of the poly A tail of mRNA in eukaryotic cells? (3%)
A. Help transcription initiation
B. Facilitate DNA replication
C. Prevent mutation
D. Prevent mRNA degradation
E. DNA repairing
8. How many hydrogen bonds are (is) present to hold a cytosine-guanine base pair in DNA? (3%)
A. 1
B. 2
C. 3
D. 4
E. 5
9. Which of the following reagents is commonly used for protein staining? (3%)
A. SDS
B. Coomassie Brilliant Blue
C. Glycerol
D. Ethidium bromide
E. DMSO
10. Which of the followings is able to bind to incompletely folded proteins to assist their folding or prevent them from aggregating? (3%)
A. Enhancer
B. Histone
C. Cyclins

D. Chaperon

E. Hapten

Part II 實驗題共 35 分

1. Homologous recombination is a mechanism by which DNA sequence can be reorganized intramolecularly and intermolecularly. Please draw maps to described the gene organization after one homologous recombination happens in X genes in each of the following cases. (The arrows indicate the genes and their orientation in the DNA molecules) (15%)



2. To clone and express a bacterial gene *x* that encodes a protein X in an expression plasmid in *E. coli*, the DNA fragment containing *x* gene has been amplified by PCR. The 5'-end and 3'-end of the coding strand sequences of the DNA fragment are shown in **Figure 1**. The sequence of the cloning region of the expression plasmid is shown in **Figure 2**. Please answer the following the questions.

甲. Which of the following primer sets was used to amplify *x* gene-containing DNA fragment? (4 %)

- A. 5'-GAATTCATATGGGATCCT-3' and 5'-AGATCTTAATCGGTCGAC-3'
- B. 5'-AGGATCCCATATGAATTC-3' and 5'-AGATCTTAATCGGTCGAC-3'
- C. 5'-AGGATCCCATATGAATTC-3' and 5'-GTCGACCGATTAAGATCT-3'
- D. 5'-GAATTCATATGGGATCCT-3' and 5'-GTCGACCGATTAAGATCT-3'
- E. 5'-GAATTCATATGGGATCCT-3' and 5'-CAGCTGGCTAATTCTAGA -3'

乙. The start codon of *x* gene is AUG. Please show the sequence of the first five N-terminal amino acids of X protein (4 %). The codon usage table is shown in Figure 3.

丙. Please show the sequence of the last five C-terminal amino acids of X protein (4 %).

丁. To express X protein as a recombinant protein with its N-terminal fused with a 6xHistidine tag (His Tag), which of the restriction enzyme sets can be used during the process of cloning? (4 %)

- A. NdeI and SalI
- B. EcoRI and BamHI
- C. EcoRI and BglII
- D. BamHI and SalI
- E. BglII and SalI

戊. To express X protein as a recombinant protein with its C-terminal fused with a 6x Histidine tag (His Tag). Which of the restriction enzyme sets could be used during the process of cloning? (4 %)

- A. NdeI and SalI
- B. EcoRI and BglII
- C. NdeI and BglII
- D. BamHI and SalI
- E. XhoI and SalI

Figure 1. The PCR product containing *x* gene to be cloned in the expression plasmid. The restriction sites indicated above the sequence are unique cutting sites.

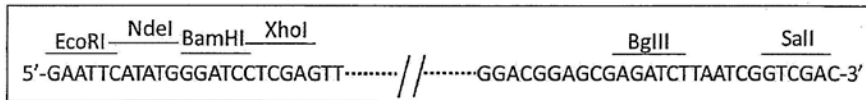


Figure 2. The cloning region of the expression plasmid. The restriction sites indicated above the sequence are unique cutting sites.

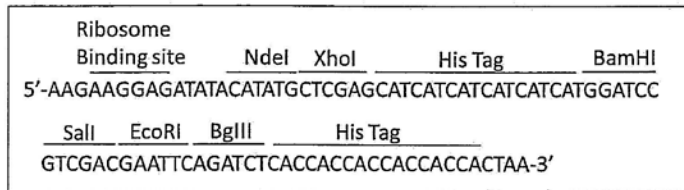


Figure 3. RNA codon table

Ala	GCU, GCC, GCA, GCG	Leu	UUA, UUG, CUU, CUC, CUA, CUG
Arg	CGU, CGC, CGA, CGG, AGA, AGG	Lys	AAA, AAG
Asn	AAU, AAC	Met	AUG
Asp	GAU, GAC	Phe	UUU, UUC
Cys	UGU, UGC	Pro	CCU, CCC, CCA, CCG
Gln	CAA, CAG	Ser	UCU, UCC, UCA, UCG, AGU, AGC
Glu	GAA, GAG	Thr	ACU, ACC, ACA, ACG
Gly	GGU, GGC, GGA, GGG	Trp	UGG
His	CAU, CAC	Tyr	UAU, UAC
Ile	AUU, AUC, AUA	Val	GUU, GUC, GUA, GUG
Stop codon	UAG, UGA, UAA		

Part III 問答題共 35 分

1. DNA replication is a complex process. Please describe the following terms regarding their roles in DNA replication. (15%)

Topoisomerase. (3%)

Single strand binding protein (SSB). (3%)

Helicase. (3%)

Okazaki fragment. (3%)

Semiconservative replication. (3%)

2. Bacteria can horizontally acquire foreign genes (e.g. antibiotic resistance genes) through transformation, transduction, and conjugation. Please describe these gene transfer mechanisms (10%).

3. Please describe CRISPR (clustered regularly interspaced short palindromic repeats) in terms of its function and mechanism in organisms and its application in molecular biology (10%).