

國立臺灣海洋大學 108 學年度研究所碩士班招生考試試題

考試科目：分子生物學

系所名稱：食品科學系碩士班生技組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

一、單選題（每題 2 分）

1. The quaternary structure of a protein is determined by
 - A. Interactions between distant amino acids of the same polypeptide
 - B. Interactions between close amino acids of the same polypeptide
 - C. The arrangement of the alpha helices and beta sheets in the protein
 - D. Interactions between amino acids of different polypeptide chains

2. The function of a molecular chaperone is to
 - A. Act as an energy source during the polymerization of amino acids into a polypeptide
 - B. Unfold proteins with the incorrect three-dimensional shape and refold them into the proper shape
 - C. Act as a carrier molecule and bring "activated" monomers to a polymer for incorporation
 - D. Bind to specific structures on the polypeptide in order to assist the folding of a protein into its correct three dimensional shape

3. Ethidium Bromide is used in electrophoresis of DNA fragments because:
 - A. It makes the DNA fragments more mobile in the gel
 - B. It increases the conductivity of electricity through the gel
 - C. It makes the fragments visible under UV light
 - D. It helps determine the size of the fragments

4. A protein is usually tagged for degradation by proteasome activity by which of the following proteins?
 - A. Kinase B. Protease C. Ubiquitin D. Ubiquinone

5. Isolated RNA molecules are generally less stable than DNA at physiological pH because:
 - A. RNA is always linear
 - B. RNA has U instead of T
 - C. there are many more RNase enzymes

D. RNA is usually single stranded

6. The chemical EDTA is routinely used in many experiments. For example, EDTA is used in electrophoresis buffer solutions. Which of the following statements is not true?

- A. EDTA is a chelator.
- B. EDTA has a strong binding affinity for divalent and some trivalent cations.
- C. EDTA is used to help denature proteins and weaken cell membranes.
- D. EDTA is a catalyst for polymer formation and essential for protein and nucleic acid polymerization.

7. DNA is a double helix molecule containing four different types of nitrogen bases. Which of the following statements regarding both the replication and chemical composition of DNA is correct?

- A. Base sequences of both strands are the same.
- B. Both strands are synthesized continuously in 5'→3' direction.
- C. The first base of the newly synthesized DNA is catalyzed by DNA polymerase.
- D. The amount of purine is equal to that of pyrimidine in a double-stranded DNA

8. What enzyme does a retrovirus primarily rely on to create a copy of its genome that is ready for integration into the host genome?

- A. DNA gyrase
- B. RNA polymerase
- C. DNA polymerase
- D. Reverse transcriptase

9. You perform a Western blot on two proteins of similar molecular weights and find only one band developed on your SDS-PAGE gel. How would you modify your assay to distinguish the two proteins?

- A. Focus your sample isoelectrically on a pH gradient
- B. Use a lower concentration of acrylamide to raise the resolution of your gel
- C. Use a non-ionic detergent to denature your protein
- D. Remove reducing agents like mercaptoethanol or dithiothreitol

10. What kind of enzyme adds phosphate groups to enzymes for the purpose of activating or deactivating them?

- A. phosphatases
- B. flippases

- C. protein kinases
- D. glycosyltransferases

11. Which of the following statement is CORRECT concerning a genome?

- A. The science of studying the DNA sequences and properties of entire genomes.
- B. The totality of genetic information belonging to a cell or an organism
- C. The genome present in the mitochondria of a eukaryotic cell.
- D. The DNA molecules present in the nucleus of a eukaryotic cell.

12. Which of the following is NOT a component of nucleotide of DNA?

- A. Ribose
- B. 2'-deoxyribose
- C. A nitrogenous base
- D. A phosphate group

13. Which of the following is an accurate statement concerning the differences between DNA and RNA?

- A. RNA is usually double-stranded, but DNA is usually single-stranded.
- B. RNA has the sugar deoxyribose, but DNA has the sugar ribose.
- C. RNA lacks the base thymine and has uracil instead.
- D. RNA contains three different nucleotides, but DNA contains four different nucleotides.

14. What is the initial product of genome expression?

- A. Proteome
- B. Transcriptome
- C. Genome
- D. Metagenome

15. All of the following statements about the genetic content of organelle genomes are true, EXCEPT

- A. Organelle genomes are much smaller than their nuclear genomes
- B. All mitochondrial genomes contain genes for the non-coding rRNAs
- C. Most chloroplast genomes possess gen for code rRNAs and tRNAs
- D. Organelle genomes specify all of the proteins found in the organelle

二、問答題（每題 10 分）

1. What is a CpG island and what role it plays in gene regulation?

2. Please describe the technique and application of DNA fingerprinting.

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1. Please define the following terms briefly. (15%)

- (1) DNA melting
- (2) RNA splicing
- (3) Riboswitch
- (4) Genetically Modified Foods
- (5) Fermentation

2. Integrated questions. (15%)

You are planning to produce recombinant SecB protein from *Escherichia coli* and its coding DNA sequence (465 bp, complete) is as follows.

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ATGTCAGAAC   AAAACAACAC   TGAAATGACT   TTCCAGATCC   AACGTATTTA
TACCAAGGAT   ATCTCTTTTCG   AAGCGCCGAA   CGCGCCGCAC   GTTTTCCAGA
AAGATTGGCA   ACCAGAAGTT   AACTTGATC    TGGATACGGC   ATCTTCCCAA
CTGGCAGATG   ACGTATACGA   AGTGGTACTG   CGTGTTACCG   TAACGGCCTC
TTTGGGCGAA   GAAACCGCGT   TCCTGTGTGA   AGTTCAGCAG   GCGGGTATTT
TCTCCATCGC   GGGTATCGAA   GGCACCCAGA   TGGCGCATTG   CCTGGGAGCA
TACTGCCCGA   ACATTCTGTT   CCCGTATGCT   CGTGAGTGCA   TCACCAGCAT
GGTATCCCGC   GGTACATTCC   CGCAACTGAA   AGGCTGGCGA   AGGTACTGAA
GAACATCAGG   ATGCC-3'
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Please answer the following questions.

(1) Please select the primers that could be used to amplify full length of the above DNA sequence by using PCR. (Multiple choices) (3%)

- (a) 5' -ATGTCAGAACAAAACAACAC
- (b) 5' -CTGAAGAACATCAGGATGCC
- (c) 5' -GGCATCCTGATGTTCTTCAG

(d) 5' -TACAGTCTTGT TTTTGT TGTG

(e) None of the above is going to work.

(2) Please explain polymerase chain reaction. (5%)

(3) Please briefly define recombinant protein. (3%)

(4) How many amino acid residues in a complete recombinant SecB protein? (2%)

(5) Please give the sequence of the first 5 amino acid residues of recombinant SecB proteins (2%).

The Genetic Code

		second position				
		U	C	A	G	
first position (5' end)	U	UUU Phe UUC UUA Leu UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA* stop UAG* stop	UGU Cys UGC UGA* stop UGG Trp	U C A G
	C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gln CAG	CGU Arg CGC CGA CGG	U C A G
	A	AUU Ile AUC AUA Met AUG†	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G
	G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G

3. Assay questions. (20%)

(1) In eukaryotes, the proteomes are normally larger than the genomes, please explain what might have contributed the proteome complexities? (10%)

(2) Please describe *lac operon* and its regulation. (10%)