

國立成功大學

112學年度碩士班招生考試試題

編 號： 294

系 所： 分子醫學研究所

科 目： 分子生物學

日 期： 0207

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。

一、單選題 Single-choice Questions (20%, 2 points/each)

1. A protein has a molecular weight of 5500 Da. How many amino acids residues the protein may have?
(A) 40
(B) 50
(C) 60
(D) 70
(E) 80
2. A double strand DNA has a molecular weight of 297000 Da. How long is the DNA molecule in base pairs?
(A) 250
(B) 350
(C) 450
(D) 550
(E) 650
3. Analysis of a DNA sample indicates that 16% of the bases are Cytosine. What is the percentage of adenosine?
(A) 9%
(B) 16%
(C) 24%
(D) 34%
(E) 68%
4. If the recombination frequencies occur between the indicated markers a, b, c, and d are: $a \times d=4\%$; $b \times c=8\%$; $a \times c=10\%$; $b \times d=14\%$; $c \times d=6\%$, what is the gene order?
(A) abdc
(B) acdb
(C) adcb
(D) bdac
(E) cbad
5. Nucleic acids absorb light strongly at which wavelength:
(A) 230 nm
(B) 260 nm
(C) 280 nm
(D) 320 nm

(E) 360 nm

6. Which of the following description about protein structure is incorrect:

- (A) The complete structure of a protein can be described at four different levels of complexity: primary, secondary, tertiary, and quaternary structure
- (B) An α -helix secondary structure is stabilized by hydrogen bonds between carbonyl oxygen and the amino group of every fourth residue in the helical turn
- (C) β -Sheets consist of extended polypeptide strands (β -strands) connected by a network of hydrogen bonds.
- (D) The tertiary structure of a protein refers to the overall three-dimensional arrangement of its polypeptide chain in space.
- (E) Prediction of a protein structure is primarily based on sequence and structural homology

7. What is the function of bacterial sigma factor?

- (A) Help the assembly of ribosome
- (B) Help elongation of the polypeptide chain during translation
- (C) Help transcription elongation
- (D) Help initiation of transcription
- (E) Help initiation of translation

8. The Kozak sequence is a nucleic acid motif that functions as:

- (A) the protein translation initiation site in most eukaryotic mRNA transcripts.
- (B) the protein translation initiation site in most prokaryotic mRNA transcripts.
- (C) the mRNA transcription initiation site in most eukaryotes.
- (D) The mRNA transcription initiation site in most prokaryotes.
- (E) transcriptional factor binding sites for promoter activation

9. Which of the following codon is a stop codon:

- (A) AAG
- (B) GAA
- (C) GUU
- (D) GUA
- (E) UGA

10. Which of the following is incorrect:

- (A) An mRNA vaccine is a type of vaccine that uses messenger RNA to produce an antigen for an immune response
- (B) The Oxford–AstraZeneca (AZ) COVID-19 vaccine uses a harmless, weakened animal adenovirus to deliver a gene encoding the coronavirus spike protein.

- (C) The Moderna mRNA vaccine is packed inside lipid nanoparticles.
- (D) DNA vaccines are significantly more temperature-stable than mRNA vaccines.
- (E) DNA vaccines are better than mRNA vaccines for the induction of potent immunogenicity.

二、簡答題 Define the following terms (30%, 3 points/each)

1. codon usage and preference
2. heterogenous nuclear RNA (hnRNA)
3. Capping and poly-A tail
4. Monocitronic and polycistronic mRNAs
5. short-inhibitory RNA (siRNA)
6. short hairpin RNA (shRNA)
7. long non-coding RNA
8. Internal ribosome entry site (IRES)
9. CpG island
10. proto-oncogene

三、問答題 Assay questions (50%)

1. What is the central dogma of Eukaryotic gene expression in molecular biology (10%)?
2. Please describe the principle of polymerase chain reaction (9%) and three of its application (6%).
3. Please describe how three main types of RNA are involved in protein synthesis (15%).
4. Please describe at least one of the mechanisms for microRNA (miRNA) to regulate gene expression (10%).