

國立成功大學
111學年度碩士班招生考試試題

編 號： 57

系 所： 生命科學系

科 目： 分子生物學

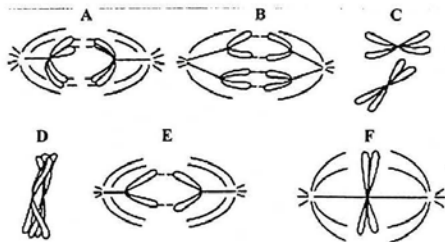
日 期： 0220

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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. Adenine makes up 38% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be guanine? (5 points)
2. Restriction enzymes used in molecular biology typically recognize short (4–8 bp) target sequences, usually “palindromic”, and cut at a defined position within those sequences. The restriction endonuclease, Sall, recognizes the sequence 5'-GTCGAC-3' and cleaves between the G and T on each strand.
 - a. What does “palindromic” mean? (5 points)
 - b. What is the calculated frequency of the Sall-recognition sequence occurring in a genome? (5 points)
 - c. The restriction endonuclease, XhoI, recognizes the sequence 5'-CTCGAG-3' and cleaves between the C and T on each strand. Do you think the sticky ends produced after XhoI and Sall cleavage could adhere to each other? Explain your choice. (5 points)
3. What is the function of the enzyme topoisomerase in DNA replication? (5 points)
 - A) elongating new DNA at a replication fork by adding nucleotides to the existing chain
 - B) reattaching the hydrogen bonds between the base pairs in the double helix
 - C) relieving strain in the DNA ahead of the replication fork caused by the untwisting of the double helix
 - D) building RNA primers using the parental DNA strand as a template
4. Different from DNA, RNA contains uracil in place of thymine.
 - a. What is a difference in structure between uracil and thymine? (5 points)
 - b. Justify the biological reason for the presence of uracil in RNA but not in DNA. (5 points)
5. In protein structure, what does “quaternary structure” mean? (5 points)
6. Refer to the drawings in the figure below of a single pair of homologous chromosomes ($2n = 2$) as they might appear during various stages of either mitosis or meiosis.



- a. Which diagram represents prophase I and anaphase II of meiosis? (5 points)
- b. Arrange the right order of meiosis progression. (5 points)

7. Explain why regulation of transcription frequently involves the promoter and protein interactions with the promoter. (10 points)
8. Explain a general mechanism for how antibiotics inhibit translation and how they specifically target bacterial cells. (10 points)
9. U1 RNA prefer to bind 5'-GUAAGU-3' sequence. If the 5' splice site sequence changed from 5'-GUAAGU-3' to 5'-GUAUGU-3', predict the effect change on U1 binding and U6 snRNP binding in an in vitro protein-RNA binding assay. (10 points)
10. You discover a new operon that is regulated by a repressor in a prokaryotic species. Assuming the repressor binds an operator site, design an in vitro experiment to identify the specific region where the repressor binds DNA under condition similar to those normally found for repression in the cell. (10 points)
11. How does the source and generation of miRNAs differ from those of siRNAs? (10 points)