國立成功大學

110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：0203

節　次：第 3 節

備　註：不可使用計算機

編號： 57

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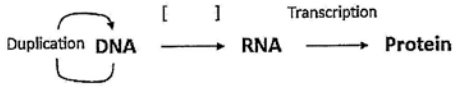
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。總分 100 分每題所占分數在題目後括弧內。第 1 題 8 分，第 2 題至第 8 題每題 4 分，第 9 題及第 10 題每題 7 分，第 11 題至第 15 題每題 10 分。

1. In 1957, Francis Crick referred to the pathway for the flow of genetic information as the central dogma:



(1) Fill the blank in the figure. (4 points)

(2) Raise an example of the reversal flow of the central dogma. (4 points)

2. _____ bonding arises from a nonspecific attractive force originating when two atoms come close to each other. (4 points)

A) Hydrogen

B) van der Waals

C) Covalent

D) Ionic

3 Which of the followings describes a difference between mitosis and meiosis in a diploid organism? (4 points).

A) Sister chromatids are segregated in mitosis, while homologous pairs of chromosomes are segregated in meiosis I.

B) Sister chromatids are segregated in mitosis, while homologous pairs of chromosomes are segregated in meiosis II.

C) DNA replication takes place prior to mitosis, but not before meiosis I.

D) Only meiosis I results in daughter cells that contain identical genetic information.

4 Cytosine makes up 36% of the nucleotides in a certain DNA sample from an organism. Approximately what percentage of the nucleotides will be adenine in this sample? (4 points).

5 Which is the most inappropriate example of the event involving ribozyme? (4 points).

A) Peptide-bond formation during protein synthesis

B) Generation of tRNA

C) mRNA splicing

D) Glycolysis

6 A homozygous fruit fly with long legs and long wings was crossed with a homozygous fruit fly with short legs and dumpy wings. The F1 all had long legs and long wings. The F1 were testcrossed by crossing them to homozygous recessive individuals, and the following offspring were obtained: (4 points).

Long legs and long wings—41
Long legs and dumpy wings—7
Short legs and long wings—8
Short legs and dumpy wings—44

How many map units separate these genes?

7 Two _____s, correctly positioned across from each other in a folded protein, can form a disulfide bond by oxidation of the two—SH groups to S—S. (4 points).
A) lysine
B) alanine
C) cysteine
D) aspartate

8 Which is the most inappropriate method to check the DNA-protein interaction? (4 points).
A) Electrophoretic mobility-shift assay (EMSA)
B) DNA footprinting
C) Yeast two hybrid assay
D) Chromatin immunoprecipitation assay (ChIP)

9 Explain briefly the difference between the secondary structure and tertially structure of a protein. (7 points).

10. COVID-19 can be detected by RT-qPCR. Explain briefly the principle of this method. (7 points)

11. Consider the Rho-independent terminator sequence 5'-CCCAGC***CCG***CCTATAGCTATGAG***CGG***GCTTTTTTTT-3' Why does a point mutation at any one of the bolded nucleotides disrupt termination of transcription? How would you test your conclusion? (10 points)

12. Describe one experiment that supports the statement that an rRNA and not a protein component of the ribosome catalyzes the peptidyl transferase reaction. (10 points)

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13. 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 conditions similar to those normally found for repression in the cell. (10 points)

14. Please describe the key features of piwi-interacting RNAs (piRNA) found in eukaryotes. (10 points)

15. Consider a light-activated gene. In the presence of persistent light, the gene turns on and soon after turns off. Which types of feed-forward loop do you expect regulates this gene? Explain your choice. (10 points)