

※ 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(每題 3 分，共 33 分)

1) Which bonds are created during the formation of the primary structure of a protein?

- A) peptide bonds
- B) hydrogen bonds
- C) disulfide bonds
- D) phosphodiester bonds
- E) A, B and C

2) What method did Frederick Sanger use to elucidate the structure of insulin?

- A) X-ray crystallography
- B) bioinformatics
- C) analysis of amino acid sequence of small fragments
- D) NMR spectroscopy
- E) high-speed of centrifugation

3) The function of each protein is a consequence of its specific shape. What is the term used for a change in a protein's three-dimensional shape or conformation due to disruption of hydrogen bonds, disulfide bridges, or ionic bonds?

- A) hydrolysis
- B) stabilization
- C) destabilization
- D) renaturation
- E) denaturation

4) Two plants are crossed, resulting in offspring with a 3:1 ratio for a particular trait. This suggests

- A) that the parents were true-breeding for contrasting traits.
- B) incomplete dominance
- C) that a blending of traits has occurred.
- D) that the parents were both heterozygous.
- E) that each offspring has the same alleles

5) Alternative RNA splicing

- A) is a mechanism for increasing the rate of transcription
- B) can allow the production of proteins of different sizes from a single mRNA
- C) can allow the production of similar proteins from different RNAs

- D) increases the rate of transcription.  
E) is due to the presence or absence of particular snRNPs
- 6) What is the most abundant type of RNA?  
A) mRNA  
B) tRNA  
C) rRNA  
D) pre-mRNA  
E) hnRNA
- 7) Which of the following is a function of a signal peptide?  
A) to direct an mRNA molecule into the cisternal space of ER  
B) to bind RNA polymerase to DNA and initiate transcription  
C) to terminate translation of the messenger RNA  
D) to translocate polypeptides across the ER membrane  
E) to signal the initiation of transcription
- 8) RFLP analysis can be used to distinguish between alleles based on differences in which of the following?  
A) restriction enzyme recognition sites between the alleles  
B) the amount of DNA amplified from the alleles during PCR  
C) the ability of the allele to be replicated in bacterial cells  
D) the proteins expressed from the alleles  
E) the ability of nucleic acid probes to hybridize to the alleles
- 9) Which describes the transfer of polypeptide sequences to a membrane to analyze gene expression?  
A) Southern blotting  
B) Northern blotting  
C) Western blotting  
D) Eastern blotting  
E) RT-PCR
- 10) Which of the following techniques used to analyze gene function depends on the specificity of DNA base complementarity?  
A) Northern blotting  
B) use of RNAi  
C) in vitro mutagenesis  
D) in situ hybridization

E) restriction fragment analysis

11) In 1997, Dolly the sheep was cloned. Which of the following processes was used?

- A) use of mitochondrial DNA from adult female cells of another ewe
- B) replication and dedifferentiation of adult stem cells from sheep bone marrow
- C) separation of an early stage sheep blastula into separate cells, one of which was incubated in a surrogate ewe
- D) fusion of an adult cell's nucleus with an enucleated sheep egg, followed by incubation in a surrogate
- E) isolation of stem cells from a lamb embryo and production of a zygote equivalent

二、問答題

1. Please describe the mechanism used for yeast mating type switch. (8 分)
2. In *E. coli*, DNA polymerase I possesses 5' exonuclease and 3' exonuclease activities, whereas DNA polymerase III possesses 3' exonuclease activity. Explain the functionality behind the differences in exonuclease activities associated with these two polymerases. (8 分)
3. Please define gene conversion and give an example of a mechanism explaining how gene conversion occurs. (8 分)
4. Please describe in detail the spliceosome-mediated RNA splicing. (8 分)
5. Please distinguish the difference between knock-out and knock-down of a gene. (10 分)
6. What is "epigenetics"? How does it regulate the gene expression? (15 分)
7. Please describe RNA interference (RNAi) and its functions. (10 分)