

※ 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。

Part I: Molecular Biology (Single choice questions(單選題); 50%, 每題 2 分):

1. Some genes located on the same chromosome do not show perfect linkage because?
 - A. They are too close together
 - B. They are interrupted by other genes
 - C. Crossover events occur between homologous genes
 - D. Some genes are deleted
 - E. Too many alleles are present

2. During an experiment with *Drosophila*, it was discovered that all females had red eyes. A conclusion based on this observation would be?
 - A. The gene for eye color is located on the X chromosome
 - B. The eye color phenotype is sex-linked
 - C. The females are homozygotes
 - D. The gene for eye color is located on an autosome
 - E. Both (A) and (B) are correct

3. Which of the following statements is not true regarding genetic mapping?
 - A. Genes are arranged in a linear order on chromosomes
 - B. Recombination occurs between chromosomes
 - C. There is a mathematical relationship between the distance separating two genes and the recombination frequency
 - D. Mapping is used to establish the location of genes relative to each other
 - E. Mapping is used to determine the composition of a gene.

4. Which of the following was demonstrated by Frederick and Griffiths?
 - A. Nucleic acid was the possible genetic material
 - B. A genetic trait can be transferred from one organism to another
 - C. Genes are linked
 - D. Crossing over occurs between chromosomes
 - E. Protein is a major component of nucleic acid.

5. The notion of one-gene/one-enzyme is true or not? If not, it is because of which of the following?
 - A. An enzyme can be composed of more than one polypeptide
 - B. Many genes contain the information for making polypeptides that are not enzymes.
 - C. The end products of some genes are not polypeptides

- D. All A-C are correct
 - E. Only A and B are correct
6. Which of the following is not a product of transcription?
- A. RNA
 - B. DNA
 - C. rRNA
 - D. tRNA
 - E. mRNA
7. The correct structure of DNA components can be presented as
- A. Phosphate-base-sugar
 - B. Phosphate-sugar-base
 - C. Base-phosphate-sugar
 - D. Phosphate-sugar-phosphate-base
 - E. Base-sugar-phosphate-base
8. Which of the following is a characteristic of double-stranded DNA?
- A. 2 nanometers in width
 - B. 10 base pairs per turn
 - C. 0.34 nanometers per base pair
 - D. A and B
 - E. A, B and C
9. Double-stranded DNA consists of two antiparallel strands, meaning that one strand is oriented in the 5' to 3' direction, while the other is oriented in the 3' to 5' direction.
- A. True
 - B. False
10. Asymmetrical spacing of the backbones of the DNA double helix generates major and minor grooves.
- A. True
 - B. False
11. Experiments conducted by Frederick Griffiths laid the foundation for?
- A. Elucidation of mRNA structure
 - B. DNA as the genetic material
 - C. The virulence of *S. pneumoniae*
 - D. The discovery of the capsule of *S. pneumoniae*
 - E. Elucidation of tRNA structure.
12. Which of the following would be the substance of choice to destroy the DNA in a solution?
- A. Ribonuclease
 - B. Trypsin

- C. Chymotrypsin
 - D. Deoxyribonuclease
 - E. None of the choices are correct
13. The analytic tools used to show that DNA was the transforming substance include all of the following except
- A. Ultracentrifugation
 - B. Electrophoresis
 - C. UV absorption spectrophotometry
 - D. Heat inactivation
 - E. Chemical analysis
14. All of the following are found in RNA except
- A. Adenine
 - B. Deoxyribose
 - C. Cytosine
 - D. Guanine
 - E. Uracil
15. Which of the following is not found in RNA and DNA?
- A. Nitrogen
 - B. Oxygen
 - C. Carbon
 - D. Sulfur
 - E. Hydrogen
16. The bonds that connect adenine to thymine in a DNA double helix are
- A. Ionic
 - B. Hydrophobic
 - C. Hydrogen
 - D. Covalent
17. The ability of two polynucleotide strands to hybridize is based on which of the following principles?
- A. Double helical nature of DNA
 - B. The presence of phosphodiester bonds
 - C. Complementary base pairing
 - D. The presence of 3' and 5' ends
 - E. The presence of covalent bonds
18. Rapid cooling of DNA following heating at high temperature will cause
- A. The strands to break
 - B. Rapid renaturation of the strands
 - C. The strands to remain separated
 - D. The double helix to form rapidly

E. Mismatching between the strands

19. Which of the following features is common to DNA, RNA, and proteins?

- A. They contain amino acids
- B. They contain nucleotides
- C. They contain uracil
- D. They are polymers.

20. The messenger hypothesis states that

- A. Messenger RNAs are very stable and are not destroyed
- B. Ribosomal RNAs carry the information for making proteins
- C. Messenger RNAs carry genetic information to ribosomes
- D. New ribosome are made to transmit new genetic information
- E. None of the choices are correct

21. A new mutant cell line was accidental created in the lab. This mutant was found to be deficient in the enzyme aminoacyl-tRNA synthetase. Which of the following would most likely to observe in this cell line?

- A. No tRNA molecules would be present
- B. tRNA molecules would contain no anticodons
- C. Most tRNA molecules would not be able to attach to amino acids
- D. Protein synthesis would increase
- E. None of the choices are correct

22. Which of the following is likely to contribute to a shift in the reading frame in an mRNA molecule?

- A. Removal a triplet code
- B. Removal of nine bases
- C. Removal of a single base
- D. Removal of six bases
- E. None of the choices are correct

23. The noncoding strand of a gene is the same as the antisense strand

- A. True
- B. False

24. An amino group, a carboxyl group, and a hydrogen are found in all amino acids

- A. True
- B. False

25. A segments of DNA is considered upstream when t is located on the 5' end of the start site.

- A. True
- B. False

Part II: Cell Biology (Essay questions (簡答題); 總分 50 分)

1. Cell transport substances across their membranes. Choose **THREE** of the following four types of cellular

transport.

- Osmosis
- Active transport
- Facilitated diffusion
- Endocytosis/exocytosis

For **each of the three** transport types you choose

- a. Describe the transport process and explain how the organization of cell membranes functions in the movement of specific molecules across membranes (15%); and
 - b. Explain the significance of **each type of transport** to a specific cell (you may use different cell types as examples) (15%).
2. Beginning at the presynaptic membrane of the neuromuscular junction, describe the physical and biochemical events involved in the contraction of a skeletal muscle fiber. Include the structure of the fiber in your answer. (10%)
3. All living cells, both prokaryotic and eukaryotic, have the following cell structures: plasma membrane, cytosol, ribosomes, and at least one chromosome. Choose **anyone** of these. Describe its basic structure (including molecular composition) as well as the function. Explain why a cell could not exist without the function(s) performed by this cell structure. (5%)
4. Choose **anyone** of the following eukaryotic cell structures for a short essay: (5%)
- Mitochondrion
 - Cytoskeleton
 - Golgi apparatus
 - Endoplasmic reticulum
 - Lysosome
 - Chloroplast (found only in photosynthetic cells)