

科目：普通生物學【生科系三年級】

## 一、Single choice (two points for questions #1~#11; three points for question #12)

1. Which protein influences the ability of RNA polymerase to transcribe genes?

- A. DNA polymerases
- B. DNA helicases
- C. transcription factors
- D. snRNPs
- E. tRNA

2. \_\_\_\_\_ enables a single gene to encode two or more polypeptides that are different in their amino acid sequence.

- A. Reverse transcription
- B. Self-splicing
- C. Capping
- D. Alternative splicing
- E. Regulatory splicing

3. Which of the following statements about RNA processing in eukaryotes is INCORRECT?

- A. Introns are excised out of pre-mRNA to produce the mature mRNA.
- B. A complex composed entirely of proteins is used to remove introns from the pre-mRNA.
- C. A poly A tail is added on to the 3' end of the mRNA.
- D. A 7-methylguanosine cap is added on to the 5' end of the mRNA.
- E. Processing occurs in the nucleus.

4. Why is the operon arrangement of genes beneficial to certain bacteria?

- A. It allows for the differential regulation of individual genes that encode proteins with a common function.
- B. It allows the coordinated regulation of a group of genes that encode proteins with a common function.
- C. It allows the separate regulation of individual genes that encode proteins with different functions.
- D. It allows the coordinated regulation of a group of genes that encode proteins with different functions.
- E. It allows for coordinated regulation of a group of proteins involved in numerous cellular activities.

5. Which of the following is FALSE when comparing RNA and DNA?

- A. Both are produced by phosphodiester linkages.
- B. Both are composed of phosphate groups.
- C. Both are composed of sugars.
- D. Both are composed of identical nucleotides.
- E. Both are composed of a phosphate group, a pentose sugar, and a nitrogenous base.

6. In producing a strand of DNA the nucleotides combine to form what type of bond?

- A. hydrogen
- B. peptide
- C. phosphodiester
- D. purine
- E. ionic

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7. How many replication forks are there at a replication origin?
- A. 1
  - B. 2
  - C. 3
  - D. 4
  - E. 5
8. The function(s) of DNA polymerase includes which of the following?
- A. DNA synthesis
  - B. DNA proofreading
  - C. removes RNA primers and fills in the gaps
  - D. DNA synthesis and proofreading
  - E. DNA synthesis, DNA proofreading, and removes RNA primers and fills in the gaps
9. Which of the following statements about telomeres is INCORRECT?
- A. Telomeres are produced by telomerase.
  - B. Telomeres are found at the ends of DNA.
  - C. Telomeres are short repeat sequences.
  - D. Telomeres would predominate more in cells of older than younger individuals.
  - E. Telomeres are crucial to the viability of a cell that replicates often.
10. A DNA specimen that contains 30% guanine has \_\_\_\_\_ thymine.
- A. 15%
  - B. 20%
  - C. 30%
  - D. 60%
  - E. The amount of thymine cannot be determined.
11. This molecule catalyzes covalent bond formation between fragments of DNA.
- A. helicase
  - B. ligase
  - C. polymerase
  - D. primase
  - E. nuclease
12. DNA associates very tightly with nucleosomes because
- A. DNA can form covalent bonds with histone proteins.
  - B. negative charges on DNA are attracted to positive charges of the histone proteins.
  - C. the histone tails wrap tightly around the DNA double helix.
  - D. the amino acids of histone proteins are largely acidic, while DNA molecules are basic.
  - E. histone H1 tightens the coils of DNA that are wrapped around the nucleosome.

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## 二、Answer the following questions

01. Describe how hormones control the metabolism and energy balance in vertebrates. (8 points)
02. What are the three processes involved in urine production? How they are regulated in maintenance of water and salt homeostasis? (8 points)
03. Describe the structure of a human ear and explain the mechanism of hearing and how the ear distinguishes sounds of different frequencies. (9 points)
04. Please explain the evidence that supports the endosymbiotic origin of photosynthetic eukaryotes. (5 points)
05. Describe the major contribution of Charles Darwin to general biology. (5 points)
06. Explain the term "biological species concept", and describe the pros and cons of this concept in term of defining "a species". (7 points)
07. Explain the term "Hardy-Weinberg Principle" and the use of this principle in population genetics. (8 points)
08. In *Arabidopsis*, formation of flower organ can be predicted by ABC model. Please predict the formation of flower organs when the plants have (a) normal classes A, B, and C genes (b) deficiency in class A gene (c) deficiency in class B gene (d) deficiency in class C gene (e) deficiency in classes A, B, and C genes. (10 points)
09. Please explain the possible mechanism of phototropism responsive to unidirectional light. (5 points)
10. There are dermal, ground and vascular tissues in plants. Please specify the following tissues to particular type of tissue mentioned above:  
epidermis, cortex, vessel, pith, stele, trichome, sieve tube, tracheid, cambium, endodermis. (10 points)

科目：生物化學【生科系三年級】

1. Give specific examples to illustrate any three biological functions of (1) carbohydrates, (2) proteins, (3) lipids, and (4) nucleotides respectively (12%)
2. Describe the four levels of protein structure and the interactions or forces that contribute to stabilizing each level of protein structure. (16%)
3. Describe any three criteria that can differentiate the biological catalysts (enzymes) and chemical catalysts used by organic chemists. (10%)
4. Give the Michaelis-Menten equation and discuss the significance of the equation. (10%)
5. Describe any three ways to modulate the activities of proteins. (10%)
6. Metabolic pathways can be organized into catabolism and anabolism. Compare the general characteristics of catabolism and anabolism. (12%)
7. Describe the stages of glucose oxidation in eukaryotic cells. (18%)
8. Describe the processes substrate-level phosphorylation and oxidative phosphorylation of forming ATP in cells. Describe. (12%)